NUCLEAR SCIENCE ABSTRACTS

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GENERAL AND MISCELLANEOUS

2245 ITR-1714
Holmes and Narver, Inc., Los Angeles.
EVALUATION OF BLAST AND SHOCK EFFECTS ON TUNNEL SUPPORT STRUCTURES. Phase II Preliminary Report. A. A. Lee and E. Y. Wong. May 1959. 37p. Project 26.13 [of] OPERATION HARDTACK. OTS.

The underground nuclear test program of Operation Hardtack, Phase II provided an opportunity to obtain test information on the effects of underground nuclear detonations on tunnels and tunnel linings. Rock breakage and tunnel lining response information was obtained by normal surveying methods, still and high-speed photography, and deflection gage instrumentation. From the limited data available it was concluded that the stress field produced by an underground nuclear detonation in tuff acts essentially as a hydrostatic load around the tunnel which would permit the use of simplified design loading for tunnel linings. The configuration of the tunnel at the zero point influences the damage-distance relationships to a large degree. The straight-end configurations produced a greater damage than the hooked-end configuration. The damage-distance relationships based on previous test (Rainier) for determining the point of closure and the point of no damage are in close agreement with results obtained from a test in a tunnel with similar hooked-end configuration. Though the damage-distance factor for straight-end tunnels is much larger, there is also a large difference in this factor between the two events which took place in tunnels with this configuration. Hence, no firm damage-distance criteria have been developed for tunnels with a straight-end configuration. (auth)

2246 P-1384(RAND)
RAND Corp., Santa Monica, Calif.
A VULNERABILITY MODEL FOR WEAPON SITES WITH INTERDEPENDENT ELEMENTS. Sidney L. Firstman. May 27, 1958. Revised Feb. 9, 1959. 26p.

A simple counting model is described which employs overlays and probability-grids, in the determination of the trade-off, measured in survival probability, between site dispersal and hardening for a weapon complex composed of several interdependent elements, separated by distances of less than two lethal radii. The survival-probability expressions are obtained through the use of Markov chains. An example of vulnerability estimation by the use of the model is included. (auth)

2247 SC-2090(TR)
Sandia Corp., Albuquerque, N. Mex.
NATURAL FREQUENCIES OF STRUCTURE 3.1.1. Lydik S. Jacobsen and William M. Wells. Nov. 2, 1951. Changed from OFFICIAL USE ONLY Nov. 17, 1959. 59p. OTS.

Preshot and postshot measurements of the natural frequencies of buildings were made. Various constructions of steel and concrete were tested using a mechanical shaker, and pickup to measure displacements. By use of these data stiffness changes caused by blast loading were calculated. Assuming a rigid foundation, calculated values of preshot frequencies were greater than measured values. Ground stiffnesses appear to be correct. Damping ratios calculated from resonance curves are low compared with values obtained by other experimenters. (J.R.D.)

2248 SCTM-32-54(51)
Sandia Corp., Albuquerque, N. Mex.
A CLASS OF CASUALTY FUNCTIONS WITH SPECIAL APPLICATION TO CIRCULAR TARGETS. Aug. 10, 1954. 35p. OTS.

Methods developed to analyze circular targets are extended to handle a particular family of casualty curves. (auth)

2249 SCTM-324-59(51)
Sandia Corp., Albuquerque, N. Mex.
RESULTS OF A FORCE TEST OF SEVEN CONFIGURATIONS OF THE ULTRA-ALTITUDE VEHICLE IN THE SANDIA CORPORATION 12- × 12-INCH TRANSONIC WIND TUNNEL (PROGRAM III–43). J. W. Arnold. Oct. 13, 1959. 73p. OTS.

Force, moment, and center of pressure information are presented for seven models of the ultra-altitude vehicle configuration. The models were tested at Mach numbers in the range $0.5 < M < 1.8$ and at angles of attack within -6 to $+10$ degrees. (auth)

2250
TECHNICAL APPLICATION OF RADIOISOTOPES IN GERMANY. E. Pohland, and K. Frenzen. Atomwirtschaft 4, 415-26(1959) Oct. (In German)

The technical application of radioactive isotopes is only just beginning in Germany. Nevertheless sealed sources are installed for production control in over one thousand thickness gages, in about four hundred filling-level indicators, and in density measuring equipment and for use in the non-destructive testing of materials. Practical examples are given of special technical processes which have been realized and of the application of open sources in technology. (auth)

2251
ELECTRIFICATION OF THE U.K.A.E.A. INDUSTRIAL GROUP FACTORIES. J. W. Binns and W. J. Outram (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). J. Brit. Nuclear Energy Conf. 4, 282-300(1959) Oct.

A description is given of some of the special electrical requirements and problems at the various factories of the Industrial Group of the United Kingdom Atomic Energy

Authority. It deals with the three main groups of the Authority's activities, chemical plants, diffusion plant, and nuclear reactors. The need for a high standard of cleanliness and ventilation, particularly in chemical plants, the maintenance of cooling systems and safety circuits for reactors, and some of the special electrical supply problems for diffusion plants are discussed. The Authority's general policy on standardization, electrical safety, construction, and lighting is stated. (auth)

2252

THE PHYSICS OF NUCLEAR EXPLOSIONS AND THE EFFECTS OF NUCLEAR WEAPONS. [PART] I. Rudolf Schrader. Naturw. Rundschau. No. 7, 268-72(1958) July. (In German)

The energy and radioactivity released by nuclear explosions are discussed, and nuclear explosions are described. Data are tabulated on: fission-product activity versus times after explosion in the ranges 0 to 12 hours, 1 hr to 3 months and gamma activity 1 hr to 1 year; fireball radius versus time (0.0001 to 1 sec); temperature (0.0001 to 3 sec); fireball radius versus explosion energy; crater depth and diameter versus surface burst energy; crater radius versus explosion depth; and wave height versus distance from ground zero in 25 m water. (T.R.H.)

2253

PHYSICS OF NUCLEAR EXPLOSIONS AND EFFECTS OF NUCLEAR WEAPONS. II. Rudolf Schrader. Naturw. Rundschau. No. 8, 299-310(1958) Aug. (In German)

A discussion is presented of the pressure, thermal and radiological effects of nuclear explosions, particular attention being devoted to radiation hazards and protection. (T.R.H.)

2254

ATOMIC ENERGY YEARBOOK. Translated Review of Genshiryoku Nenkan. Tokyo, Japan Atomic Industrial Forum. 1957. 587p.

A general chronology of the development of atomic energy is given. The situation in Japan is treated in detail and a collection of documents, treaties and regulations, development plans, budgetary statistics, Japanese patents, world fuel deposits, world reactors, etc., is given. A who's who in atomic energy in Japan is included. The book is intended as a source book for managerial and administrative personnel in atomic energy and not as a technical reference work. (W.D.M.)

2255

VSESOYUZNAYA NAUCHNO-TEKNICHESKAYA KONFERENTSIYA PO PRIMENENIYU RADIOAKTIVNYKH I STABIL'NYKH IZOTOPOV I IZLUCHENIY V NARODNOM KHOZYAYSTVE I NAUKE; MASHINOSTROYENIYE I PRIBOROSTROYENIYE. (Transactions of the All-Union Conference on the Use of Radioactive and Stable Isotopes and Radiation in the National Economy and Science; Machine and Instrument Manufacturing). Moscow, Izd-vo AN SSSR, 1958. 358p.

A collection of papers covering a wide field of the utilization of tracer methods in industrial research and control techniques is presented. The topic of this volume is the use of radioisotopes in the machine- and instrument-manufacturing industry. The individual papers discuss the applications of radioisotope techniques in the study of metals and alloys, problems of friction and lubrication, metal cutting, engine performance, and defects in metals. Several papers are devoted to the use of radioisotopes in the automation of industrial processes, recording and measuring devices, quality control, flowmeters, level gages, safety devices, radiation counters, etc. (TCO)

BIOLOGY AND MEDICINE

General and Miscellaneous

2256 COO-219

Utah. Univ., Salt Lake City. Radiobiology Lab.
SEMI-ANNUAL PROGRESS REPORT. C. N. Stover, Jr., ed. Sept. 30, 1959. 66p. Contract AT(11-1)-119. OTS.

Progress is reported in long-term studies on the toxic effects of radioactive heavy metals in dogs. Data are included on the pathological effects of plutonium-239, radium-226, and strontium-90. Changes were observed in the iris following the injection of radium-226. The observed eye changes developed in a predictable sequence, and the degree of change was related to injection dose. The average radiation dose to the skeleton was determined for dogs which succumbed. Data are tabulated on fibrinogen values in plasma from experimental dogs and the tissue distribution of injected strontium-85, strontium-90, radium-226, and thorium-228. (C.H.)

2257 CF-59-10-126

Oak Ridge National Lab., Tenn.
LONG-TERM ECOLOGICAL STUDY OF THE OAK RIDGE AREA: II. OBSERVATIONS ON THE MAMMALS WITH SPECIAL REFERENCE TO MELTON VALLEY. J. C. Howell and P. B. Dunaway. Oct. 26, 1959. 24p. OTS.

The study of the mammals occurring in Melton Valley had two important functions: first, to secure ecological information about this important segment of the animal life and, second, to select areas suitable for long-term studies of the ecological effects of radiation. Records of occurrence of 27 species of mammals in the area were secured by qualified observers. The level of mammal populations in the valley was low except near streams. The fertility of the soil is also low except in the valleys along streams, and the litter and humus are thin. During the period from June 5 to August 1, 1958, 48 specimens representing 5 species were collected with snap-back traps, live traps, and pitfall traps in habitats of 4 plant successional stages. (auth)

2258 LAMS-2356

Los Alamos Scientific Lab., N. Mex.
ON SOME MATHEMATICAL PROBLEMS SUGGESTED BY BIOLOGICAL SCHEMES. Charles Luehr. Aug. 1958. 25p. Contract W-7405-eng-36. OTS.

A simplified model of a population which reproduces asexually and is subject to random mutations implying improvement in chances of survival and procreation is treated by a numerical calculation. The behavior of such a system is then summarized by an analytical formula. The paper is intended as the first one of a series devoted to mathematical studies of simplified genetic situations. (auth)

2259 NP-8043

Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 33. Oct. 15, 1959. 139p. Contract AF41(657)-252.

The degree of modification of the radiation-induced increase in the adenosine triphosphatase activity of the spleen and thymus glands and decreases in the acetylcholinesterase activity of the small intestines of rats pretreated with various chemical combinations was used as a means of quantitatively determining the radioprotective effects of chemical agents. The protection provided to these tissues by the drug combinations is expressed in terms of per cent reduction of the radiation dose which was obtained from the direct relationship between the

dose of irradiation and the magnitude of enzyme changes at three days after exposure to 400 r. Data are included on the effects of various combinations of 2-mercaptoethylamine, 2-aminoethylisothiuronium dichloride, glutathione, hydroxyacetonitrile, and cysteine. Results of 30-day survival studies on animals treated with some of these combinations before exposure to otherwise lethal doses of radiation are included. A method for measuring the serum levels of injected dithiocarbamic acid derivatives was devised by utilizing the known ability of these compounds to form a colored chelate with copper. The rate of absorption of sodium diethyldithiocarbamate was measured after intraperitoneal injection. Results are reported from initial studies on the reactivity of dithiocarbamates with enzymes of intermediary carbohydrate metabolism. The influence of x irradiation on the ability of rats to metabolize drugs was studied. A quantitative enzymatic method was developed for measuring the activity of drug metabolizing enzymes in liver microsomes. A comparison of the activity of drug metabolizing, microsomal enzymes in the livers of various species demonstrated that the livers of mice, rats, and guinea pigs contain the enzymes. A marked sex difference was observed in rats. Results are included from a study of the effects of sex, testosterone, and hepatectomy on enzyme activity. Eighty compounds were tested for protective activity against the lethal effects of 800 r of whole-body x irradiation in mice. Results are tabulated. Results are reported from studies on the radioprotective effects of adrenochrome, epinephrine, and serotonin immediately prior to the administration of a lethal dose of whole-body x irradiation, and the effect of Adrenosem on the adenosine triphosphatase activity and tissue respiration of normal and x-irradiated animals. Data are included on the effect of various metallic ions on radiation lethality in mice and on the kinetic and synthetic aspects of the acid-catalyzed reactions of aziridines with thiourea and its analogs. The design, construction, and calibration of a 10 curie cobalt-60 irradiation facility are described. Studies were carried out to add to the existing information concerning the effect of fractionation and protraction on mortality in mice following exposure to x radiation. (For preceding period see NP-7786.) (C.H.)

2260 NYO-2063

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

SEMI-ANNUAL REPORT FOR PERIOD ENDING JUNE 30, 1959. Hymer L. Friedell. 114p. Contract W-31-109-eng-78. OTS.

Progress is reported in the following studies: the influence of x radiation on the development and incidence of leukemia in mice; the mechanism of the protective action of cysteine against the effects of x rays on fibroblasts grown in tissue cultures; the effects of x radiation on metabolic activity in liver cells; purine metabolism in ascites tumor cells; the effect of irradiation on fibroblasts in tissue cultures; the effects of various media and environmental conditions on the growth of cells in tissue cultures; the effects of radiation of the growth of cells in tissue cultures; the effect of segmental gut shielding on mortality of rats from intestinal radiation; the pathogenesis of the intestinal radiation syndrome; the development of a pulsed electron accelerator; the development of an instrument for organ radioisotope visualization; the development of time lapse photomicrography equipment; and the design of an improved automatic tissue culture system. (C.H.)

2261 UCRL-8901

California. Univ., Berkeley. Lawrence Radiation Lab.

A BIBLIOGRAPHY OF BIOLOGICAL APPLICATIONS OF AUTORADIOGRAPHY, 1958 THROUGH 1959. Muriel E. Johnston. Aug. 1959. 23p. Contract W-7405-eng-48. OTS.

This bibliography of 281 reports and published literature references on biological applications of autoradiography is a supplement to the one published July 1958 as UCRL-8400. References previously omitted are included. (J.E.D.)

2262 WASH-1023

Rochester, N. Y. Univ. Atomic Energy Project.

PROCEEDINGS OF THE SECOND ANNUAL MEETING ON BIO-ASSAY AND ANALYTICAL CHEMISTRY, NOVEMBER 3 AND 4, 1958. Sept. 15, 1959. 155p. OTS.

Separate abstracts have been prepared on the papers presented at this conference. (C.H.)

2263 WASH-1023(p.7-20)

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE DETERMINATION OF FLUORIDE IN HUMAN URINE. T. Kwasnoski. 14p.

A calorimetric Eriochrome Cyanine R method is described for determining fluoride in urine samples after distillation in an automatic distillation unit. The apparatus used is illustrated photographically and the sensitivity of the method is discussed. (C.H.)

2264 WASH-1023(p.21-8)

Combustion Engineering, Inc. [Nuclear Div.], Windsor, Conn.

DETERMINATION OF FLUORIDE IN SOIL. G. S. Golden and J. Pauroso. 8p.

A procedure is described for the determination of fluorine in soil samples by photometric determination of fluoride after direct distillation. (C.H.)

2265 WASH-1023(p.29-44)

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

ELECTRODEPOSITION OF ENRICHED URANIUM IN URINE. T. P. Hamrick. 16p.

A program is described for monitoring personnel engaged in handling uranium. Urine samples are collected on an assigned date which is always preceded by two scheduled days off. The samples are refrigerated and delivered to the laboratory. Samples are prepared for electrodeposition within twenty-four hours and are counted on an alpha proportional counter. Data are recorded on a pre-punched IBM card. The card provides the necessary information to evaluate worker exposure. It also locates cases of unusually high exposure so that a more thorough examination and determination of dose may be made. (C.H.)

2266 WASH-1023(p.46-58)

Oak Ridge National Lab., Tenn. and Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

AN INHALATION EXPOSURE TO U_3O_8. R. R. Fish and G. R. Patterson, Jr. 13p.

An industrial worker accidentally received an inhalation exposure to enriched uranium fume during October 1957. This case has been studied by several methods in an effort to estimate the magnitude of the lung burden. A description of the accident illustrates the difficulty in detecting this type of exposure through the use of air sampling alone. Samples of urine were analyzed fluorometrically and by two different electrodeposition procedures. Blood samples and specimens of feces were analyzed also to aid in estimating the inhaled dose. Five separate estimates of the initial lung burden, based upon the bioassay data and in vivo counting, agree that the dose was in the range 1 to 10 mg, and was probably close to 4 mg. (auth)

2267 WASH-1023(p.59-70)

National Lead Co. of Ohio, Cincinnati.

ETHYL ACETATE EXTRACTION OF URANIUM FROM

HUMAN AND ANIMAL TISSUES. M. W. Boback. 12p.

Tissue specimens were dry ashed, dissolved in acid and the uranium extracted with ethyl acetate from a solution saturated with aluminum nitrate. Recoveries of submicrogram quantities from pure and spiked tissue solutions are listed. Uranium levels are reported for lung (0.04 to 1.7 μg/g of wet tissue), kidney (0.02 to 0.09 μg/g), spleen (0.02 to 0.04 μg/g), bone (0.02 to 0.08 μg/g) and other tissues from workers exposed to uranium dusts in industrial situations. Concentrations are also given for several steer tissues and for specimens from persons with no known uranium exposure. References cited include works on the separation and determination of microgram and submicrogram quantities of uranium in various materials and reports on uranium in human and animal tissue. (auth)

2268 WASH-1023(p.71-83)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A REVIEW OF SIGNIFICANT HANFORD PLUTONIUM DEPOSITION CASES. R. H. Wilson. 13p.

This paper reviews several incidents of plutonium exposure which occurred at the Hanford production plant. A brief description is given of the circumstances that resulted in internal deposition of plutonium and the treatment given each employee. Biological data collected in each case are presented along with interpretation of these data in terms of body burden. (auth)

2269 WASH-1023(p.84-100)

Dow Chemical Co. [Rocky Flats Plant], Denver.

PLUTONIUM EXCRETION FOLLOWING ACUTE ACCIDENTAL EXPOSURE. S. E. Hammond. 17p. (RFP-128).

Theories of plutonium metabolism and excretion in humans have had to depend mainly on the extrapolation of animal data. Cases presented here add to the limited human data available, point out both anomalies and agreements with theory derived from idealized animal experiments, and contribute experimental results of exposures to mixed compounds and multiple modes of entry into the body. (auth)

2270 WASH-1023(p.101-6)

Argonne National Lab., Lemont, Ill.

A COBALT AND A TRITIUM INCIDENT AT ARGONNE NATIONAL LABORATORY. J. Sedlet, J. Robinson, and W. Fairman. 6p.

Data are presented which were obtained following the accidental exposure of two men to cobalt-60 inhaled in dust and two tritium exposures at the CP-5 reactor. Data on elimination of cobalt-60 and tritium are tabulated. The accidents are described and data are included on radiation dosage received by the individuals exposed. (C.H.)

2271 WASH-1023(p.107-12)

Rochester, N. Y. Univ. Atomic Energy Project.

SOME HYDROLYSIS CONCEPTS RELATED TO THE SOLUBILITY OF METALLIC COMPOUNDS IN VITRO AND IN VIVO. I. Feldman. 6p.

All metallic ions form hydrates in aqueous solution, surrounding themselves with a few tightly-bound water molecules and a large number of weakly-bound water molecules. The latter are held by van der Waals forces only and form a nebulous volume around the few chemically-coordinated inner or nearest-neighbor group of water molecules. This inner coordination sphere of water greatly affects the chemical properties of metallic ion solutions, to a much greater extent than is generally pointed out in elementary texts. It is usually recognized that the dissolution of a metallic salt may be represented by $M_m A_a \xrightarrow{H_2O} m\,M(H_2O)_x^{+a} + a\,A(H_2O)_y^{-m}$ where the H_2O represents chemically-coordinated water and the nebulous outer water is ignored. Such an equation is sufficient for certain salts such as NaCl or KCl, but for metals whose ions have high charge/size ratio, such as Li^+, Be^{2+}, Al^{3+}, etc., this equation can lead to erroneous conclusions. In actual fact, salts of high charge density hydrolyze to some extent immediately upon dissolution. For most of them the hydrolysis is followed by some slower polymerization. Reaction mechanisms involved in olation, oxolation, anion penetration, and the formation of radiocolloids are discussed. The term radiocolloid is applied to substances which show colloidal properties even though the solubility product for macro-concentration would indicate that the tracer solution should be a true solution. Radiocolloid formation was noticed at about the same pH where macro-concentration of the same cation would be precipitated, suggesting the radiocolloid may be a polymer formed by hydrolysis and olation. With tracer polonium reproducible amounts of filterable polonium were obtained at pH 7. It is pointed out that extreme care must be taken to obtain reproducible results with metals which have a tendency to polymerize. The relationship between the polymerization tendency of a metal and difficulties encountered in solving its toxicity problems is discussed briefly. (C.H.)

2272 WASH-1023(p.113-36)

Rochester, N. Y. Univ. Atomic Energy Project.

SOME PHYSICAL AND PHYSIOLOGICAL FACTORS CONTROLLING THE FATE OF INHALED SUBSTANCES. P. E. Morrow. 24p.

Dust deposition is the active process wherein dust is removed from the air while it is being respired. The term implies the extent to which dust is removed in terms of the same measure of dustiness as used to characterize the inspired air. Some faction of the dust deposited is not in reality on the surface membrane of the respiratory tract but in suspension within the lung air. In the over-all course of dust deposition the amount of dust so involved is relatively small and short-lived and is particularly insignificant when deposition is measured as a steady state condition. Dust deposition in the respiratory tract can be thought of as a process occurring within a small compartment of air with the same physical forces in control that are involved in the dust deposition from the environmental air outside of the body. The forces of interest include gravitational, inertial, and Brownian motion. Physiological and other factors governing the deposition of dust in the respiratory tract are reviewed. Attempts to predict deposition as a function of physiologic measurements are discussed. (C.H.)

2273 WASH-1023(p.137-55)

Rochester, N. Y. Univ. Atomic Energy Project.

MECHANISM OF CLEARANCE OF INHALED PARTICULATES FROM THE LUNG. L. J. Casarett. 19p.

Several mechanisms have been proposed by which a particle may move or be moved within the lung or out of the lung. Some of these have been demonstrated adequately while others are in considerable doubt. Observations are described which were made following the administration of polonium-210 to rats via the lung. A diagram of the exposure apparatus is included. Data are tabulated and photographs of tissue sections are included. (C.H.)

2274

RADIATION BIOLOGY AND ISOTOPE UTILIZATION IN APPLIED BOTANY. H. Glubrecht (Technischen Hochschule, Hannover). Atompraxis 5, 276-80(1959). (In German)

A short survey is given of the problems being studied in

the Institute for Radiation Biology in the Technische Hochschule in Hannover. Extensive data are presented on a method of studying the effect of ionizing radiation on plant cells with the aid of UV microspectroscopy. From the change in UV absorption in ranges of a few μ^2, conclusions can be drawn as to the probability of primary ionizations in protein molecules and nucleic acids. (auth)

2275

METHODS AND APPARATUS RADIOTOPOGRAPHY. I. P. Shmelev (Inst. of Biological Physics, Moscow). Biophysics (USSR) (English Translation) 4, 108-19(1959).

Radiotopography is a set of techniques that give a picture of the distribution of gamma-emitters in physical or biological objects. Applications in biology and medicine are discussed and illustrated. (C.H.)

2276

EFFECTS OF DEUTERIUM OXIDE ON THE SYNTHESIS OF T5 AND T7 BACTERIOPHAGES. E. L. Rothstein, L. A. Manson, R. Hartzell, Jun, David Kritchevsky (Wistar Inst. of Anatomy and Biology, Philadelphia). Nature 184, Suppl. No. 15, 1167-8(1959) Oct. 10.

Tabulated data are presented from a study of the effects of deuterium oxide on metabolism and growth of Escherichia coli and two strains of bacteriophages. (C.H.)

2277

BEHAVIOR OF P32 IN TRACER STUDIES. Sterling R. Olsen and Frank S. Watanabe (U. S. Dept. of Agriculture, Fort Collins, Colo.). Soil Sci. 88, 256-9(1959) Nov.

The same chemical reactions occur when P^{32} and P^{31} exist in solution in the orthophosphate form. Phosphorus-32 serves as an accurate tracer for P^{31}. Addition of P^{32} and P^{31} to calcite showed that these two isotopes display the same chemical reactions, and that nonorthophosphate forms were absent in the P^{32} sample. Possible differences in ionic form are suggested to account for the anomalous behavior of P^{32}. (auth)

2278

NEW X-RAY CONTRAST MEDIUM IMPROVES VISUALIZATION OF THE GALL TRACT. (to Farbenfabriken Bayer Aktiengesellschaft). German Patent DAS 1033 855. July 10, 1958. Atompraxis 5, 329(1959). (In German)

An x-ray contrast medium which can be used in cholecystography is described. It consists of a compound which contains two halogen pyridone radicals, especially radicals of 3,5-diiodide-4-pyridone, bound to aliphatic carbon atoms in organic phenols. A contrast material from this sort of compound should make possible a much higher visualization of the gall tract and bladder in x-ray pictures than is possible with the compounds known at present. An improved tolerance is also obtained. The pyridone derivatives of phenols are used in the form of salts with inorganic or organic bases and injected intravenously. (J.S.R.)

2279

NEW PATIENT TABLE PREVENTS SHADOW REGION BY BEAM DURING RADIOTHERAPY. (to Siemens-Reinger-Werke Aktiengesellschaft). German Patent DAS 1039 192. Sept. 18, 1958. Atompraxis 5, 329(1959). (In German)

An improved patient table for use in radiotherapy and diagnostics is described. (J.S.R.)

2280

X-RAY OPAQUE MEDIUM FOR VISUALIZATION OF THE VASCULAR SYSTEM. (to Aktiebolaget ASTRA). German Patent DAS 1039 199. Sept. 9, 1958. Atompraxis 5, 330 (1959). (In German)

The x-ray opaque medium described is used with a viscosity-increasing substance for injection into the vascular system. The volume ratio between the contrast medium and the viscous material is selected so that the ratio between the dynamic viscosity and the specific weight of the solution is the same as the ratio in the blood. The advantages of the medium are that the liquid has the same flow properties as the blood and therefore it mixes well with the blood. (J.S.R.)

2281

NEW THERAPEUTIC APPLICATOR. (to Buchler and Co.). German Patent DAS 1 040 709. Oct. 9, 1958. Atompraxis 5, 376(1959). (In German)

A therapeutic applicator with small space requirements and which makes possible safe positioning of the beam on the site to be treated and guarantees exact exposure times is described. The radiator is mounted on an opaque carrier which can swing from the position where the radiator approaches the place to be irradiated to a position where the beam is absorbed or greatly reduced by the applicator partition. (J.S.R.)

2282

METHOD FOR THE OBTENTION OF EFFICIENT SUBSTANCES FOR FIGHTING THE MALIGNANT GROWTH OF WHITE BLOOD CELLS. Hans Julius Wolf and Norbert Gerlich. German Patent DAS 1048 676. Jan. 15, 1959. Atompraxis 5, 329(1959). (In German)

It is assumed that in healthy spleen there is a substance which prevents the uncontrolled growth of white blood cells. To manufacture the preparation, finely pulverized spleen from healthy animals is homogenized in water by strong acid or alkaline reactions, heated with stirring to 80°C. The non-soluble components separate, and the proteins are then precipitated. The filtrate is acidified to pH 4 to 4.5, and the precipitate occurring is removed. The precipitate is dissolved in glacial acetic acid and separated by repeated fractional precipitations in ether, acetone, and petroleum ether. The enriched effective substance is then isolated from the petroleum ether fraction. (J.S.R.)

2283

NEW METHOD FOR THE PREPARATION OF X-RAY OPAQUE MEDIUM CONTAINING BARIUM SULFATE. (to A. Wander A. G.). German Patent DAS 1 052 640. Mar. 12, 1959. Atompraxis 5, 376(1959). (In German)

Barium sulfate preparations which are suitable for x radiology of the esophagus, stomach, and all parts of the intestine must fulfill the following requirements: easy usability, high adhesive strength and uniform distribution on the mucous membrane, low inclination to sedimentation in the stomach and intestinal media, absence of tendencies to obstipation, and maintenance of a normal peristaltic intensity. The x-ray opaque medium with these properties was prepared so that finely dispersed barium sulfate is mixed with an inert protective colloid, a strongly peptizing medium, a dispersion agent, and water. The mixture was then dried in the usual manner. Deep, nongranular x-ray pictures could be produced with this material. (J.S.R.)

Biochemistry, Nutrition, and Toxicology

2284 UR-556

Rochester, N. Y. Univ. Atomic Energy Project. METABOLISM IN THE RAT STUDIED BY ISOTOPE TECHNIQUES. II. THE BODY BURDEN OF MERCURY AFTER SINGLE AND MULTIPLE INJECTIONS. A. Roth-

stein and A. Hayes. July 16, 1959. 17p. Contract W-7401-eng-49. OTS.

The whole-body counts indicate three phases in the clearance of mercury from rats, a rapid phase involving 35% of the dose, lasting for a few days; a slower phase involving 50% of the dose with a half time of 30 days, and finally a slow phase involving 15% of the dose with a half time of approximately 100 days. After the first few days, most of the mercury is located in the kidney so that the two slow phases of excretion represent mainly the clearances from the kidney. The patterns were the same for mercury whether administered by the intravenous or the intramuscular route. With different dose levels (5 to 50 μg per rat) the clearances by whole-body counting were approximately the same on a percentage basis. The pattern of distribution in the organs was also similar for all dosages except for a somewhat smaller localization in the kidney at lower doses. This, in turn, may be related to changes in excretion patterns. With lower doses the urinary excretion was diminished, but the fecal excretion was increased, so that total excretion was only slightly altered. With a series of five injections at 21-day intervals, each dose was handled in the same way with respect to total clearance from the body and tissue distribution. No special localization was found in the brain which might be related to the chronic toxic manifestations of mercury on the central nervous system. (auth)

2285

VOPROSY TOKSIKOLOGII RADIOKTIVNYKH VESHCHESTV. (Problems in the Toxicology of Radioactive Substances). David Iosifovich Zakutinskii. Moscow, Medgiz, 1959. 150p.

General problems in the toxicology of radioactive substances, the effects of radioactive substances on living organisms, conditions which influence the nature of effect of these substances, and clinical aspects and therapy of radiation sickness are considered. Much of the text is devoted to various after effects of radiation sickness and the influence of radioactive substances on posterity. Chemical, physical, and toxicological data on various elements, including radioactive elements used in medical practice are also presented. (TCO)

Fallout and Radiation Ecology

2286 AFSWC-TN-59-5

Air Force Special Weapons Center, Kirtland AFB, N. Mex. AIRCRAFT CONTAMINATION FROM RESIDUAL STRATOSPHERIC NUCLEAR WEAPON DEBRIS. Marvin C. Gaske, Richard R. Spore, Jr., and James L. Dick. Mar. 1959. 42p. Project No. 7806.

When nuclear weapons of relatively large yields are detonated, radioactive debris is carried high into the atmosphere. Some of this material is trapped in the stratospheric region forming a reservoir of fission fragment debris. This material diffuses back to the surface of the earth with a half fall-out time on the order of years. As a result of the presence of this contamination, nearly all operational aircraft have some radioactivity. Those which fly above the tropopause collect considerably more contamination than those which operate at a lower altitude. Data have been collected and are presented to show the nature and amount of the radioactive contamination on several representative groups of Air Force aircraft. For aircraft which generally operate below the tropopause, the highest measured external radiation levels rarely exceed 0.05 mrad/hr. Maximum external radiation levels detected on high performance aircraft such as the F-102 and B-52 were on the order of 0.1 mrad/hr on isolated spots. There was no detectable airborne contamination in the cockpits or in the immediate vicinity of any of the aircraft. It is concluded that there is essentially no measurable radiation exposure to either flight or aircraft-maintenance personnel resulting from residual radioactive bomb debris in the atmosphere, and neither radiation monitoring nor decontamination of aircraft is warranted if the aircraft have not penetrated fresh nuclear clouds. (auth)

2287 ANL-6047

Argonne National Lab., Lemont, Ill. ENVIRONMENTAL RADIOACTIVITY AT ARGONNE NATIONAL LABORATORY. Report for the Year 1958. J. Sedlet. Aug. 1959. 43p. Contract W-31-109-eng-38. OTS.

Data are tabulated on the radioactive content of samples of surface water, lake and stream bottom silt, soil, plants, and air filters from the environs of the Argonne National Laboratory. Results are compared with those for similar samples collected from the area from 1952 through 1958. Fission product activity from nuclear detonations was found in most samples from all locations. Fall-out activity was greatest during the spring and fall, and was particularly noticeable in air, precipitation, and plant samples. (For preceding period see ANL-5934.) (C.H.)

2288 CRC-850

Atomic Energy of Canada Ltd., Chalk River, Ont. THE ANALYSIS OF THE STRONTIUM-90 LEVELS IN CANADIAN MILK UP TO 1958. W. E. Grummitt, A. P. James, and H. B. Newcombe. Sept. 1959. 36p. (AECL-908). AECL.

An increase in the level of strontium-90 in Canadian milk has been observed during the last decade. The most significant increase was noted during 1956, 1957, and 1958. The absolute increase between 1957 and 1958 differed significantly from station to station. Data are tabulated and discussed. (C.H.)

2289

STUDIES ON THE RADIOACTIVE CONTAMINATION OF THE HUMAN ENVIRONMENT. I. SOIL AND PLANT LIFE. W. Herbst (Universität, Freiburg i.B). Atompraxis 5, 280-4(1959). (In German)

Various stations in the biological passage of radionuclides in soil and plants were studied by observations of a fall-out model and by experimental radioactive labeling of processes. The particular risk of incorporating radioactive substances via biocycles with food as a vehicle is discussed. Experiments with P^{32} and Sr^{90} as labels show the dependence of soil sorption upon the type and condition of the soil, and upon ion antagonisms in the soil, as well as sorption stability toward precipitation effect. The periodic table of the elements is used to show the particular tendencies of the higher plants toward an excessive uptake of fission products. In sandy soil the humus component lessens the Sr^{90}-uptake of plants through the roots. P^{32} in plants is released from the roots into the milieu through ion exchange at the rate of ca 1% per day. Radioactive contamination of the sprout organs can result in a cuticular uptake of nuclides or a surface sorption of radioactive substances. The length of the vegetation period is an important factor in determining the extent of contamination in the fall-out field. Vegetation has a filter effect in regard to radioactive material in the atmosphere. (auth)

2290

OBSERVATION ON THE PRECIPITATION AND AIR MONITORING IN ERLANGEN-BRUCK. Rudolf Neuwirth

(Fa. Frieseke and Hoepfner GmbH., Erlangen-Bruck, Ger.). Atompraxis 5, 284-8(1959). (In German)

Measurement of radioactivity in precipitation and air is reported. The methods used are described briefly, and the results are listed and discussed. The results for 1958 and 1959 are compared with each other. Monitoring of activity in the air showed maximum values on the registering strips. It was found that these striking maximum values were produced by radioactive "hot particles." Evaluation of the registering strips provides information on the weekly frequency of these particles and also on their relation to activity. It was found that the frequency of the particles varies greatly, and also that the particles with the lowest activity appear most frequently. More than 90% of all the particles observed have an activity of less than 30×10^{-12} c. Continual monitoring provides extensive data, which keep the statistical margin of error relatively small. A table shows the frequency of radioactive particles in relation to activity per cubic meter of air. No definite statement can be made about the effectiveness of the filter used to separate these particles. (auth)

2291

AGE DETERMINATION OF NUCLEAR FISSION PRODUCTS IN THE ATMOSPHERE. F. Ludwieg (Universität, Göttingen, Ger.). Atompraxis 5, 339-42(1959). (In German)

The age of fission products in the atmosphere is calculated with the aid of the activity relationships of Ba^{140}, Sr^{89}, and Sr^{90}. A technique for determining the decay rates of these radionuclides is described. The possibilities and limitations of age determination are illustrated by reference to previous studies. (auth)

2292

GAMMA SPECTROMETRY OF ARTIFICIAL RADIONUCLIDES COLLECTED BY FILTRATION OF THE AIR AT GROUND LEVEL. Giuseppina Aliverti, Francesca Demichelis, and Giuseppe Lovera. Atti acad. nazl. Lincei. Rend., Classe sci. fis., mat. e nat. 26, 772-3(1959) June. (In Italian)

The radioisotopes in the atmosphere were filtered and the gamma activity was counted from March 9 to April 24, 1959, in Naples. The results showed that the reciprocal of the activity approximates a straight line. It was deduced that the artificial activity originated from a single event about 40 days before the collection. The energy interval was from 0.25 to 1.80 Mev. Peaks were observed at 0.36, 0.49, 0.75, 0.82, and 1.62 Mev, and the isotopes to which these were assigned are tabulated. The presence of traces of Cs^{137} was not excluded. (J.S.R.)

2293

THE MODIFICATION OF ACUTE MORTALITY IN MICE BY VARIATION OF THE DOSE-RATE AND THE OVERALL TIME OF IRRADIATION. M. J. Corp and F. E. Neal (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Radiation Biol. 1, 256-65(1959) July.

A method is described whereby a 250 Kvcp x-ray set has been used to simulate whole-body irradiation by the fall-out from a nuclear weapon during the first 25 hours after its explosion when the dose-rate is continuously varying. $LD_{50/30}$ from such a fall-out exposure was 8% less than the $LD_{50/30}$ for a 25-hr exposure at a constant dose-rate. Both these values were more than 50% greater than the $LD_{50/30}$ for a short exposure lasting less than a quarter of an hour at a dose-rate about a hundred times greater. During the first 30 days after irradiation there was no qualitative difference between any of the groups in the times of death or in the manner of death. Hemorrhages were the commonest cause of death and were seen mostly in the brain and spinal cord. Deaths between 30 and 200 days were seen only in the high dose-rate group. They were due to a characteristic gastrointestinal distrubance. (auth)

2294

BACKGROUND RADIATION FROM GROUND SURFACE IN JAPAN. T. Dōke, M. Hattori, A. Sasaki, A. Nakamoto, and Y. Takami (St. Paul's Univ., [Tokyo]). J. Atomic Energy Soc. Japan 1, 53-63(1959) June. (In Japanese)

Scintillation counters and gray wedge pulse height analyzer were used to measure γ-ray spectra from ground surfaces, and it was certified that there was a considerable amount of γ-ray contributions from fall-out to background radiations in the field. Out-door radiation dosages were measured, distinguishing fall-out radiations from natural background γ rays (as a dosage to human body at the height of 1 m). Experiments to estimate radiation dosages from natural background γ rays were also tried. In Kanto loam area, the radiation dosage from natural background γ rays is small, about one third of the world average. In Kansai district, the dosage is about equivalent or a little larger than the world average radiation dosage. (auth)

2295

DISTRIBUTION OF ACTIVITY IN THE RADIOACTIVE RESIDUES FROM ATMOSPHERIC PRECIPITATION. V. Mageru, D. Blănariu, and I. Gabe (Sectia de Cercetări Fizice, Academie R. P. R., Jassy). Naturwissenschaften 46, 553(1959). (In German)

Measurements of the radioactivity of atmospheric precipitation at Jassy in 1958 were found to depend on the orientation of the sample. It was concluded that the long-lived activity of some samples could be traced to single very-active particles. (T.R.H.)

2296

MEASUREMENTS OF THE AIR ACTIVITY WITH AN ELECTROFILTER. Wolfhard Kern (Universität, Bonn). Nukleonik 1, 314-19(1959) Oct. (In German)

Measurements made with an electrofilter described earlier (Nukleonik 1, 191(1959); NSA 13-11806) and designed for the precipitation of radioactive fission products from the atmosphere are reported. The essential results show that the frequency maximum of the size of radioactive particles, which are found in the air for a long time, lies between 0.5 and 3μ. The fission product activity of the air is distributed very unevenly in small zones—especially in the origin of clouds. Measurements of the air activity should therefore be made only with a minimum volume of several hundred cubic meters. The activity of single fission product granules over 10^{13} c can be determined autoradiographically. The largest part of the old granules have an activity between 10^{-12} and 10^{-11} c. Occasionally highly active single particles of approximately 10^{-9} c occur. These are separated and can be investigated individually. The electrofilter is especially suitable for the collection of a large number of these particles because of its high air throughput. (tr-auth)

2297

CRITICAL OBSERVATIONS ON THE ESTIMATION OF THE RADIOACTIVE POISONING ON THE BASIS OF TOTAL ACTIVITY MEASUREMENTS. Günter Herrmann, Hubert Hauser, and H. Jürgen Riedel (Universität, Mainz). Nukleonik 1, 305-14(1959) Oct. (In German)

As a result of the analysis of the fission product mixture from nuclear warfare research, it is shown that the total activity measurements in rain and drinking water and their

evaluation at a maximum permissible concentration for isotopic mixtures of unknown composition (10^{-8} μc/ml) lead to a considerable over estimation of the radiation danger. Determinations of Sr^{90}, Sr^{89}, Ba^{140}, I^{131}, and the total activity in rain water and snow from July 1956 to July 1957 confirm this interpretation. Whereas the total activity measured was one hundred times the permissible level, the hazardous isotope Sr^{90} reached 95% and Sr^{89}, Ba^{140}, and I^{131} are <1% of the permissible concentration. For the natural radioisotopes RaD (Pb^{210}) and Ra^{226} 1 to 3% of the permissible concentration was observed. Altogether the activities over the time studied were total activity 490, Sr^{90} 2.1, Sr^{89} 27, Ba^{140} 28, I^{131} 14, and RaD 1.1 mc/km^2. A comparison of the composition found with that expected from the age of the mixture shows that Sr^{90} is in high excess, whereas the quota of the other isotopes detected correspond to the value expected. From an analysis of the constituents, it was found that 85% of the Sr^{90} precipitated comes from the stratosphere. The fall-out of the stratospheric Sr^{90} varies with the time of the year, with a maximum in the summer months. (tr-auth)

2298

RATIO OF CESIUM-137 AND STRONTIUM-90 RADIOACTIVITY IN SOIL. Philip F. Gustafson (Argonne National Lab., Lemont, Ill.). Science 130, 1404-5(1959) Nov. 20.

The similarity in genesis and the more pertinent physical characteristics of fission-produced Cs^{137} and Sr^{90} suggests the use of the first as a convenient monitor for the other prior to uptake in the biosphere. Results are presented which indicate the feasibility of this approach in the case of soils. (auth)

Radiation Effects on Living Tissues

2299 AECU-4475

New York. State Agricultural Experiment Station, Geneva.
FINAL REPORT [ON EFFECTS OF RADIATION ON APPLES AND GRAPES]. Charlotte Pratt. [1959]. 3p. Contract AT(30-1)-1541. OTS.

Dormant and growing apple trees and grape vines were exposed to x rays, gamma rays, or thermal neutrons. Data on the site of radiation damage and the induction of somatic mutations are summarized. A list of publications during the period is included. (C.H.)

2300 AECU-4476

Minnesota. Univ., Minneapolis.
THE EFFECTS OF RADIOACTIVE SUBSTANCES ON PLANT PATHOGENS AND OTHER MICROORGANISMS. Annual Report for Year, October 1, 1958 to September 30, 1959. Sept. 1959. 25p. Contract AT(11-1)-42. OTS.

Alpha radiation and ultraviolet radiation were used to induce mutants in Phytophthora infestans, Gibberella fujikuroi, Fusarium conglutinans, and Pestalotia sp. The number of mutants produced by irradiation in these organisms was significantly greater than from natural causes. A minimal medium on which Phytophthora isolate 510 (race O) would not grow was developed. This medium was used to select irradiated isolates of 510 which would grow on it. Twenty-one such isolates were selected in this manner and tested for pathogenicity. No such isolate had pathogenicity increased over the parent, two decreased, and the other nineteen remained the same. An analysis of the variability in colony growth of isolates of race O of Phytophthora infestans indicates that there may be more difference between isolates of the same race than between races in growth rate, depending upon which medium the organisms were grown. There is an indication that ultraviolet irradiation may influence the number of setae per conidia in Pestalotia sp. More conidia were observed with 3 setae in irradiated colonies than in non-irradiated ones. Studies with Gibberella fujikuroi to determine the utilization of sugars as carbon sources indicate ribose to be the best of the 14 sugars tested. A fluorometric analysis for gibberellins was adopted and substituted for the Pinto bean bioassay previously reported. Since the fluorometric method is entirely physical-chemical it was faster and therefore more isolates were tested with more replicates for each test, than by the bioassay method. In the testing program 172 isolates of Gibberella fujikuroi were tested for gibberellic acid production. No isolates were found which produced significantly more than the parent. (auth)

2301 AMRL-403

Army Medical Research Lab., Fort Knox, Ky.
GRID VARIABLES INFLUENCING THE SURVIVAL OF X-IRRADIATED MICE. J. G. Kereiakes and A. T. Krebs. Nov. 9, 1959. 10p. Project No. 6-59-08-014-01.

The studies on partial-body shielding by grids confirm the beneficial effects of this radiation dose distribution procedure on the survival of x-irradiated mice. This beneficial influence is exerted only if the dose transmission to the tissue surrounding the damaged tissue does not exceed 8 to 10% (for 900 r midline tissue dose). In the otherwise supralethal dose range, shielding by the use of grids does not result in a significant increase in survival. At a 1200 r midline dose, the survival time is still significantly greater for smaller aperture size grid. However, at midline doses higher than 1600 r, mice irradiated through smaller aperture size grid have a shorter mean survival time. Radiation dose transmission through closed area of grid has greater effect on smaller aperture size grid. (auth)

2302 NP-8083

Colorado. Univ., Boulder and Army Medical Research and Nutrition Lab., Denver.
THE NUTRITIONAL ADEQUACY AND PROBABLE TOXICITY OF FOODS PRESERVED BY IONIZING RADIATIONS. Progress Report No. 12 [for] March 15, 1959 to September 15, 1959. Norman F. Witt, Merrill S. Read, William S. Worth, and Harold M. Trabosh. 16p. Contract DA-40-007-MD-549.

Data are tabulated from studies on the effects of an irradiated 15-item composite diet on growth and metabolism in rats. Data are included on the effects of the addition to the diet of thiamine and pyridoxine supplements, menadoine, bile acids, and Synkayvite. Data are included on the effects of irradiation on properties of skim milk. (C.H.)

2303

MEGAPHEN TREATMENT AND RADIO-INDUCED MUTATION RATES IN DROSOPHILA MELANOGASTER. H. Lüers (Universität, Berlin). Atompraxis 5, 288-90 (1959). (In German)

Megaphen, administered alone or in combination with other substances, prevents somatic radiation injury to a recognizable extent, but does not reduce the radiation-induced mutation rate in Drosophila. (auth)

2304

WASP EGG PRODUCTION AND HATCHABILITY AFTER THE MOTHERS HAVE BEEN EXPOSED TO MIXTURES OF RADIATIONS. Daniel S. Grosch (North Carolina State Coll., Raleigh). Atompraxis 5, 290-2(1959).

Definitive doses of a combination of x and β rays and of γ and β rays are not additive in the induction of permanent cessation of insect egg production. Also, hatchability, used

in further assessment of radiation damage, reflects predominance of one component. Recommendations for radiation pest or parasite control should be based upon the component determined predominant by biological experiments, rather than on total dose. (auth)

2305

LETHAL EFFECT OF Co^{60} RADIATION IN MICE. F. Ellinger and B. F. Lindsley (Naval Medical Research Inst., Bethesda, Md.). Atompraxis 5, 293-6(1959).

Mice exposed to Co^{60} gamma radiation under 4π geometry showed a higher dose equivalent expressed in r/air when compared to radiation doses producing an equal percent mortality using 200 KVP x rays in unilateral exposure and by providing for saturation backscatter. The weight curves of mice irradiated with Co^{60} gamma radiation under the conditions of this experiment showed no significant differences from pertinent observations made on animals exposed to 200 KVP. The observation of a lesser effect of Co^{60} gamma radiation as used in this experiment agrees in principle with the results of other investigators and our previous work on guinea pigs, but quantitatively the ratio of doses are not identical in these two animal species. The species specific differences observed at 200 KVP exist, however, also in the case of the Co^{60} gamma radiation. The guinea pig is in both instances the more radiosensitive animal species. The present as well as previous studies indicate the difficulties of extrapolation to man of animal studies concerned with the lethal effect of total body irradiation. Further studies along the lines in other animal species are urgently needed in order to obtain appropriate base line data for the assessment of radiation hazards in man. Co^{60} gamma radiation as used in these experiments recommends itself for pharmacological studies in irradiated animals for the following reasons: a) it permits the exposure of large numbers of animals in one relatively short exposure, necessary for such studies; b) because of the demonstrated very satisfactory reproducibility of lethal doses; and c) because of the absence of a notable influence of saline injections on these mortality rates. (auth)

2306

MEASUREMENT OF THE RADIATION INACTIVATION OF PEPSIN USING A RADIOACTIVE SUBSTRATE. I. EFFECT OF INORGANIC IONS AND pH. M. K. Loken, K. W. Stenstrom, J. F. Marvin, and D. G. Mosser (Univ. of Minnesota, Minneapolis). Atompraxis 5, 296-9(1959).

Using radioactive iodinated serum albumin (RISA) or hemoglobin as a substrate, some effects of roentgen rays on pepsin were investigated. The results obtained with the RISA method show that an exponential relationship exists between loss of enzyme activity and dose of x rays. The sensitivity of pepsin to radiation is markedly affected by the presence of various organic and inorganic ions. Part of this effect may be attributed to the pH of the enzyme solutions during irradiation. Higher concentrations of the acids used, with the exception of citric acid, render the pepsin more radiosensitive. The protective effect of citric acid is likely associated with the reaction of the organic ions with the active radicals formed in water by the x rays or their complexing with radiosensitive sites on the pepsin molecules. These differences are apparent from the data using the RISA substrate. The experimental errors were too great when the other methods (colorimetric and spectrophotometric) were used to permit their use for evaluation of the effect of different ions. (auth)

2307

TISSUE WEIGHT CHANGES IN THE RAT AFTER 2000 r PARTIAL BODY X-IRRADIATION. W. O. Caster (Univ. of Minnesota, Minneapolis). Atompraxis 5, 342-4(1959).

Weight changes occurring in 14 different portions of the body of rats at three periods following exposure to 2000 r directed either to the head, chest or abdomen are reported. The largest changes were observed when radiation was directed only to the head. (auth)

2308

THE EFFECT OF CERTAIN NUCLEOTIDES AND NUCLEOSIDES ON THE REGENERATION OF HAEMOPOIETIC TISSUE AFTER IRRADIATION. Z. Karpfel, J. Soška, and V. Drasil (Inst. of Biophysics, Czechoslovakian Academy of Sciences). Biophysics (USSR) (English Translation) 4, 64-71(1959).

The effect of transplantation or injection of certain nucleotides and nucleosides on haemopoietic tissue after irradiation was investigated experimentally. Their in vitro action was estimated by their effect on DNA synthesis in a bone marrow tissue suspension. In in vivo experiments the survival of irradiated and control animals was compared and the blood picture was examined. In the conditions under which our experiments were carried out, certain desoxyribonucleotides had a positive effect. Ribonucleotides had no substantial effect, while desoxyribonucleosides had a detrimental effect. (auth)

2309

THE EFFECTS OF IONIZING RADIATION ON SORPTION BY FREE CELLS. E. A. Ivanitskaya (Inst. of Biological Physics, Moscow). Biophysics (USSR) (English Translation) 4, 72-6(1959).

Erythrocytes and Erlich ascites cells were used to study the effects of x rays on the sorption of Ag^{110}-labeled colloidal silver. Control cells reach equilibrium with the colloid in 5 to 10 min at 37°C. Doses of 1000 r reduce the sorption; the maximum reduction (40%) is found after 24 hr. Much less silver is taken up at 0°C. The erythrocytes' electrokinetic mobility is reduced by radiation. The sorption behavior of erythrocytes and of Erlich ascites cells is changed by irradiation. The changes indicate that the surfaces are affected, and that the effects are related to metabolic processes. (auth)

2310

THE EFFECT OF RADIATION DOSE ON THE RESISTANCE OF IRRADIATED ERYTHROCYTES IN ALKALINE MEDIUM AND THE LATENCY OF ALKALINE HAEMOLYSIS. K. S. Trincher (Inst. of Biophysics, Moscow). Biophysics (USSR) (English Translation) 4, 77-83(1959).

The resistance of irradiated erythrocytes to the subsequent effect of an alkaline medium was greatly reduced in comparison with the resistance of unirradiated erythrocytes. This phenomenon is evidently connected with radiation damage of the lipoid components of the lipoproteins in the surface layer of the cell. The resistance of irradiated erythrocytes to the subsequent effect of an acid medium was approximately the same as that of unirradiated erythrocytes. The dependence of the latent period associated with alkaline hemolysis on the dose of radiation appeared to be a simple decreasing exponential function. It is suggested that the surface layer of an erythrocyte contains a large number of independent radio-sensitive spots, which are subject to radiation damage according to the target theory. (auth)

2311

MINERAL UPTAKE BY PLANT ROOTS AFTER X-IRRADIATION. I. M. Vasil'ev and N. D. Rybalka (Inst. of Biological Physics, Moscow). Biophysics (USSR) (English Translation) 4, 83-7(1959).

Wheat seedlings were given radiation doses of 1000, 3000, 5000, 10,000, and 50,000 r. It was found that mineral

uptake is very insensitive to radiation, and is almost unaffected by the above doses. A slight stimulation was detectable immediately after doses of 3000 and 5000 r, but the effect soon vanished. Doses of 10,000 and 50,000 r depressed the uptake somewhat. (auth)

2312

HUMAN EXPOSURE TO RADIATION. Karl Z. Morgan (Oak Ridge National Lab., Tenn.). Bull. Atomic Scientists 15, 384-9(1959) Nov.

A review is given on the maximum permissible radiation doses to humans considering both industrial and medical exposures. A comparison of common x-ray exposures is made between various medical examinations. (C.J.G.)

2313

LATE EFFECTS OF CHRONIC RADIATION BURDEN. O. Hug (International Atomic Energy Agency, Vienna). Bull. schweiz. Akad. med. Wiss. 14, 501-16(1958). (In German)

Late effects from irradiation may be the result of local or generalized immediate damage and then shows a threshold-value of the dose and a definite time intensity factor. Other late symptoms of damage may develop independently of the nature and degree of the immediate damage and may have a similar relation to the dose as genetic radiation effects. These forms of damage appear to be due to irreversible changes of molecular or cellular units which manifest themselves only later in life and in connection with ageing processes. Also tumors caused by irradiation show an analogous pathogenetic difference. In contrast to radiation cancer after high local doses of irradiation, animal experiments have shown an increase in spontaneous rate of numerous tumors after irradiation of the entire organism or of larger portions of the body. Dose-effect relation and time intensity factor as well as histology indicate different types of carcinogenic mechanisms, whereby both a direct carcinogenic action and also a non-specific furthering of tumor development are probable, and for both there is experimental support. Such an increase in the general tumor diathesis depending on the dose has not yet been shown in humans. It is often assumed a priori that also some late effects of radiation in man have a linear dependency on dose without threshold value. The evaluation of the hazard to man arising from an increase in radiation level will depend on the truth of this assumption. (auth)

2314

ON THE CYTOGENETIC EFFECT OF SMALL DOSES OF IONIZING RADIATION IN MAMMALS. Yu. J. Kerkis, G. M. Ronichevskaya, and Yu. M. Rukavishnikov (Inst. of Cytology and Genetics, Siberian Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 128, 397-9(1959) Sept. 11. (In Russian)

Cytogenetic effects of 4-r doses on the frequency of chromosome alterations in spermatogonium of 20 guinea pigs were analyzed as a criterion of the genetic influence of small doses on mammals. Experiments showed an exceptionally high radiosensitivity of guinea pigs to small doses, indicating that cytological radiation effects depend not only on the size of the dose but also on the peculiarities of irradiated organisms. The formerly postulated theory on radiosensitivity on various types of mammals was verified. (R.V.J.)

2315

THE INFLUENCE OF α-RADIATION ON THE PROLIFERATIVE FUNCTION OF THE EPIDERMIS. F. L. Leites (State Univ. of Health Resort Studies and Physiotherapy). Doklady Akad. Nauk S.S.S.R. 128, 400-03(1959) Sept. 11. (In Russian)

The rapid development of irradiation injuries observed during α irradiation of the epidermis, followed by proliferative stimulation, confirmed the hypothesis stating that irradiation-induced cell disturbances take place mainly during the mitotic phase and are related mostly to disturbances in cell division mechanisms. The rapid regeneration of skin tissue following radiation injuries attests to the positive effects of stimulation as a means of liquidating radiation injuries. The unique epidermis reactions to α-irradiation are obviously induced by the special properties of α rays (high ionization density causing a higher biological effectiveness than β and γ rays). (R.V.J.)

2316

THE METAMORPHOGENIC ACTIVITY OF THYROID TISSUE IN ANIMALS SUBJECTED TO IRRADIATION. E. A. Lyalin (Central Scientific-Research Inst. of Medical Radiology). Doklady Akad. Nauk S.S.S.R. 128, 404-6(1959) Sept. 11. (In Russian)

The influence of total-body exposure on thyroid hormone synthesis and content was investigated in order to learn the pathogenesis of irradiation injuries and the therapy of sickness. 330 white male mice were exposed to various types of irradiation: (1) single exposure to Co^{60} of 1000 r (500 r/hr); (2) chronic irradiation (1000 r dose) for 8 days (with 5.6 r/hr) and (3) chronic exposure to 800 r administered during 90 days of continuous irradiation at 0.42 r/hr. The data showed metamorphogenic activity changes related to the type of irradiation. The single exposure induced an acute radiation injury causing a sharp drop in metamorphogenic activity followed by progressively weakening activity. The extended exposure to the same dose also reduced the metamorphogenic activity followed by restoration to normal after a short time. The chronic exposure initially retarded thyroid activity which later was restored to normal, even with continuous exposure and increased doses. (R.V.J.)

2317

THE EFFECT OF IONIZING RADIATIONS ON OXIDATION PROCESSES IN LEAVES OF THE TEA AND TOBACCO PLANT. O. A. Virovets and A. G. Pasynskiĭ (Bakh Inst. of Biochemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 128, 407-10(1959) Sept. 11. (In Russian)

Experimental data indicated that tea leaf oxidation is induced by enzyme fermentation action rather than by direct radiation effects. The ionizing radiation upsets the internal structure of leaves causing contact between enzymes and substratum similar to that caused by mechanical action in breaking. Similar data were derived for tobacco leaves though the oxidation changes are much slower due to low humidity. The results are of general interest as they verify the character of radiation action in plant tissue. (R.V.J.)

2318

CHANGES OF THE CEREBRAL ELECTRICAL ACTIVITY IN CATS AFTER WHOLE-BODY X IRRADIATION. H. Gangloff and T. J. Haley (Univ. of California, Los Angeles). Experientia 15, 397-9(1959).

In cats with permanently implanted electrodes, hippocampus and amygdala consistently showed spike discharges immediately after relatively low doses of whole-body x irradiation (400 r), and reticular arousal thresholds were transitorily decreased. Thalamic recruiting thresholds increased later, while hippocampal seizure thresholds remained practically unaltered. Experiments with lower doses are in progress. (auth)

2319

RADIOSENSITIVITY IN PLANTS. I. DETERMINATION OF LD-50 IN CULTIVATED PLANTS. (PRELIMINARY REPORT). Tarô Fujii and Seiji Matsumura (National Inst. of Genetics, Misima, Japan). Idengaku Zasshi 33, 389-97 (1958) Dec.

Dry dormant seeds of 43 species were exposed to various doses of gamma radiation from a cobalt-60 source. The seeds were sown 5 to 10 days after irradiation. Radiosensitivity was determined on the basis of germination rate, survival rate of seedlings at one month, and the survival rate and growth of mature plants. Data are tabulated. (C.H.)

2320

X-RAY INDUCED RECIPROCAL TRANSLOCATIONS IN TRADESCANTIA PALUDOSA. Hiroshi Watanabe (Kyushu Dental Coll., Kokura, Japan). Idengaku Zasshi 34, 162-7 (1959) May. (In Japanese)

A study was made of reciprocal translocations in Tradescantia chromosomes following exposure to doses of 5,000 and 10,000 r x radiation. Data are tabulated on meiotic pairing of the x-ray induced translocation strains and on pollen fertility in the original and x-ray induced translocation strains. (C.H.)

2321

THE RELATIVE BIOLOGICAL EFFICIENCY OF SINGLE DOSES OF FAST NEUTRONS AND GAMMA-RAYS ON VICIA FABA ROOTS AND THE EFFECT OF OXYGEN. I. REDUCTION OF ROOT GROWTH. G. J. Neary, S. M. Tonkinson, and F. S. Williamson (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Intern. J. Radiation Biol. 1, 201-15(1959) July.

Primary roots of Vicia faba have been irradiated with fast neutrons of mean energy 3 Mev in air-saturated or air-free water at about 22°C, or by cobalt-60 gamma-rays in air-saturated water at about 19°C. The reduction in root growth in terms either of total growth in 10 days, or of minimum growth rate, has been taken as the measure of the biological effect of the radiation. The dose-response curves with neutrons and gamma-rays in air-saturated water are of different shapes, so that there is no single value of relative biological efficiency. The rbe was about 15 for small doses and fell to a minimum of about 7 as the dose was increased. The form of the variation was consistent with what would be expected if reduction of root growth is principally due to chromosome damage. The presence of oxygen increases the radiosensitivity to fast neutrons; the ratio of equivalent doses in air-free and air-saturated water at 22°C is about 1.4. There is some indication that the oxygen factor is highest for small doses and falls steadily with increasing dose. (auth)

2322

THE RELATIVE BIOLOGICAL EFFICIENCY OF SINGLE DOSES OF FAST NEUTRONS AND GAMMA-RAYS ON VICIA FABA ROOTS AND THE EFFECT OF OXYGEN. II. CHROMOSOME DAMAGE: THE PRODUCTION OF MICRONUCLEI. H. J. Evans, G. J. Neary, and F. S. Williamson (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Intern. J. Radiation Biol. 1, 216-29(1959) July.

The frequency of micronuclei resulting from acentric chromosome and chromatid fragments induced by cobalt-60 gamma radiation and by ~3 Mev fast neutrons has been studied in the root-tip meristematic cells of Vicia faba. Roots irradiated with gamma-ray doses of 107 and 188 rads whilst in aerated water showed a greater micronuclear frequency than roots irradiated with similar doses in the absence of oxygen. The ratio of doses given in nitrogen and in air in order to produce the same micronuclear yield was found to be about 2.4. With roots irradiated with fast-neutron doses of 2.02, 4.95, and 9.94 rads the effect of oxygen is less marked, the nitrogen/air dose-ratio being about 1.4. For a given level of chromosome damage produced under conditions of aeration, neutron radiation was found to be about 10.5 times as effective as gamma-rays. Because of the quantitative difference in the response of the two types of radiation to the presence of oxygen, the relative biological efficiency of neutrons to gamma-rays under anoxic conditions would be about 18 to 1. (auth)

2323

THE RELATIVE BIOLOGICAL EFFICIENCY OF SINGLE DOSES OF FAST NEUTRONS AND GAMMA-RAYS ON VICIA FABA ROOTS AND THE EFFECT OF OXYGEN. III. MITOTIC DELAY. C. J. Neary, H. J. Evans, S. M. Tonkinson, and F. S. Williamson (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Intern. J. Radiation Biol. 1, 230-40(1959) July.

The efficiency of ~3 Mev fast neutrons and cobalt-60 gamma rays in inducing mitotic delay in the primary root-tip meristematic cells of Vicia faba has been studied. Fast-neutron doses of 2.02, 4.95, and 9.94 rads given under aerated and anoxic conditions, and gamma-ray doses of 46 and 114 rads given under conditions of aeration were used. The results show that there is no qualitative difference between neutron- and gamma-ray-induced mitotic delay, but marked quantitative differences were observed. The relative biological efficiency of fast neutrons to gamma-rays was about 10:1, a value comparable to those obtained for inhibition of root growth and the production of micro-nuclei. The presence or absence of oxygen had little influence on the amount of mitotic delay induced by a given dose of neutron radiation. This oxygen enhancement factor of 1 for neutrons is in marked contrast to the oxygen factor of 2 found for mitotic delay induced by gamma-radiation. The factors for both the radiations appear to be a little smaller for this effect than for inhibition of root growth and for chromosome damage. The radiobiological implications of the values of rbe and oxygen factor are discussed. In spite of the similarity of these factors for chromosome damage and mitotic delay, it is concluded that these effects do not stem from the same cellular lesion. (auth)

2324

THE EFFECTS OF X-RADIATION ON THE PROCESSES LEADING TO DNA-SYNTHESIS IN REGENERATING RAT LIVER. J. J. Jaffe, L. G. Lajtha, June Lascelles, Margery G. Ord, and L. A. Stocken (Univ. of Oxford). Intern. J. Radiation Biol. 1, 241-6(1959) July.

X radiation exposure of partially-hepatectomized rats with 200 or 400 r at 6 or 12 after operation produced a rise in desoxyribonucleoside level in the livers. This persisted for about 12 hr and was associated with a delay in the appearance of desoxyribonucleotides. (auth)

2325

MODIFICATION OF RADIATION-INDUCED INTESTINAL INJURY IN RATS BY CHILLING AFTER IRRADIATION. W. D. Gude, A. C. Upton, and T. T. Odell, Jr. (Oak Ridge National Lab., Tenn.). Intern. J. Radiation Biol. 1, 247-55 (1959) July.

Chilling of the small intestine of the rat immediately after x-irradiation postponed depression of the mitotic count and degeneration of the crypt cells. Mitotic depres-

sion and cellular degeneration occurred, however, when the tissue was re-warmed. The effects of transient chilling at 18°C were essentially identical to those of chilling at 5°C. The inhibition of colchicine-induced metaphase arrest and of tritiated thymidine uptake in chilled crypt cells suggests that postponement of the signs of radiation injury resulted from suppression of metabolic activity and cell division at low temperature. Although there was some suggestion of reduced injury in the chilled tissues, the protective or recovery-promoting effectiveness of hypothermia remains to be established. (auth)

2326

RADIATION-INDUCED TISSUE BREAKDOWN. IV. THE SOURCE OF DEGRADED AMINO ACIDS IN IRRADIATED RATS. Georg Gerber, Gisela Gerber, K. I. Altman, and L. H. Hempelmann (Univ. of Rochester, N. Y.). Intern J. Radiation Biol. 1, 277-87(1959) July.

An attempt was made to determine the source of excess C^{14}-labeled glycine and phenylalanine observed in free metabolic pools of rats loaded with glycine-2-C^{14} and phenylalanine-3-C^{14} before irradiation. Tissues from various organs of irradiated and non-irradiated rats were fractionated into three protein fractions. Glycine, phenylalanine, tyrosine, serine, and alanine were isolated from these fractions, and the respective specific activities were determined. Differences in specific activities were: decreased activity in muscle collagen and soluble-protein fractions of thymus and spleen; increased activity in soluble-protein fractions of liver and muscle; and variable changes in the activity of certain amino acids of the soluble-protein fraction of kidney. The significance of these changes is discussed in terms of known biological effects of radiation on cells and cellular metabolism. Muscle collagen seems radiosensitive and its increased catabolism in irradiated rats could explain much of the excess C^{14}-activity in free amino-acid pools. (auth)

2327

MODIFICATION OF X-RAY DAMAGE TO THE LENS BY PARTIAL SHIELDING. Antoinette Pirie and S. M. Drance (Univ. of Oxford). Intern. J. Radiation Biol. 1, 293-304 (1959) July.

We have examined the effect of irradiation of half the lens of the eye of the rabbit on the development of cataract and on the histology of the lens epithelium. Shielding one-half of the lens lessens the damage caused by irradiation in the other half. This lessening of damage, which is made evident by a less severe cataract, fewer nuclear fragments, smaller mitotic overshoot and reduced subsequent cell loss in the irradiated epithelium, does not appear to be due to cell migration from healthy to irradiated area. We suggest that lessening of the damage is caused by diffusion of substances into the irradiated area from other parts of the lens or eye. (auth)

2328

EFFECT OF HYDROGEN PEROXIDE ON EHRLICH ASCITES TUMOR CELLS DURING γ-IRRADIATION. H. Takayama, K. Hirano, K. Nishioka, and T. Sunada (Osaka Univ.). Med. J. Osaka Univ. 10, 219-25(1959) Aug.

Since it is known that oxygen deficiency protects against γ-irradiation, it was assumed that an excess of oxygen or of some similar substance might promote the biological effects of γ-irradiation. H_2O_2 was tested as that assumed promotor. A mixture of Ehrlich ascites tumor cells and H_2O_2 (which was so dilute as to cause no death of cells) was irradiated in vitro with γ-rays for a single dose lower than the dose necessary to prevent the irradiated cells from producing ascites tumors. The irradiated mixture was injected intraperitoneally into mice. Although control animals all died of ascites tumors, the experimental group into which H_2O_2 treated irradiated cells were injected did not show ascites tumor death after two months observation. These effects were not found when benzperoxide was substituted for H_2O_2. Ferric chloride was used in an attempt to increase the production of the HO_2 radical but had no effect. (auth)

2329

CROSS-LINKING OF DEOXYRIBONUCLEIC ACID IN SPERM HEADS BY IONIZING RADIATIONS. P. Alexander and K. A. Stacey (Royal Cancer Hospital, London). Nature 184, 958-60(1959) Sept. 26.

Nucleoprotein obtained from the sperm of fish was irradiated in an attempt to isolate the deoxyribonucleic acid. After irradiation by 20,000 to 1,000,000 rads with 1-Mev electrons, the sperm heads were dissolved in 2 M NaCl and purified by precipitating the protamine with sodium dodecyl sulfate. Upon removal of the protamine complex it was found that a substantial fraction of the deoxyribonucleic acid was lost and that this loss was related to the radiation dose. The remaining deoxyribonucleic acid was found to have gel-like properties which were interpreted as cross linking. Cross-linking efficiency of the reaction and biological implications are discussed. (C.J.G.)

2330

DECREASE IN RADIOSENSITIVITY OF THE INTACT MOUSE SPLEEN PRODUCED BY HYPOXIA. L. Weiss (National Inst. for Medical Research, London). Nature 184, Suppl. No. 15, 1156-7(1959) Oct. 10.

Results are reported from a study of the effects of severe hypoxia on the intact spleen of irradiated mice. Observations from histological examination of the spleens are reported. (C.H.)

2331

VARIATIONS OF THE WHITE BLOOD PICTURE FOR CHRONIC IRRADIATION BURDEN DUE TO Sr^{90} INCORPORATION IN THE ALBINO RAT. Helga Melchinger (Heiligenberg-Institut, Baden, Ger.). Naturwissenchaften 46, 562(1959). (In German)

Injections of 5, 10, 20, 40, and 80 μC Sr^{90}–γ^{90} were made in groups of 230 g. white rats. Plots are shown of leukocyte values for the 10 and 80 c groups over a period of weeks. The results obtained so far are discussed but the experiments are continuing. (T.R.H.)

2332

X-RAY EFFECTS ON SECONDARY ORGANIZER-ACTION. Asoke Bose (Presidency Coll., Calcutta). Naturwissenschaften 46, 563(1959).

The effects of x-irradiation dose on chick blastoderms are discussed. The 600-r dose seems to be of particular significance in organizer action. (T.R.H.)

2333

EFFECT OF ULTRAVIOLET PRETREATMENT ON YIELD OF MUTATIONS BY X-RAYS IN WHEAT. M. S. Swaminathan and A. T. Natarajan (Indian Agricultural Research Inst., New Delhi). Science 130, 1407-9(1959) Nov. 20.

A decrease in the yield of chromosomal aberrations in root meristems of wheat induced by four different doses of x rays has been found to occur when the seeds are pretreated with ultraviolet radiation. However, in X_2 generation, the mutation rate for combined treatment is lower than for x rays alone in lower dosages and higher than for x rays alone in higher dosages. (auth)

2334

INFLUENCE OF NATURAL AND ARTIFICIAL HIBERNATION ON THE RADIOSENSITIVITY OF LIVING CELLS AND TISSUE. Gian Giuseppe Palmiere and Roberto Miceli (Universität, Bologna). Strahlentherapie 110, 161-78(1959).

The authors submit three sets of experiences in irradiating animals and men in natural and artificial hibernation. The findings obtained by the observation, show as a rule a lower reactivity of tissues, organs, and the whole organism in respect of the irradiation, when the irradiated subject is in one or the other above mentioned states. (auth)

2335

COMPARATIVE ANALYSIS OF THE EFFECT OF IONIZING AND ULTRAVIOLET RADIATION, HIGH TEMPERATURE, AND THE PHOTODYNAMIC EFFECTS ON MICROORGANISMS. Erhard Geissler (Deutsche Akademie der Wissenscaften, Berlin). Strahlentherapie 110, 192-6 (1959). (In German)

Microorganisms under different biological experimental conditions have the same relative sensitivity to ultraviolet and ionizing radiation, high temperatures, and the photodynamic effect. Almost always an inhibition of mitosis can be observed, which can be more or less reversed by proper treatment. Possibly the noxious agents cause the same definite effect, which is at least temporal not identical with the specifically released primary effect. (auth)

2336

BIOLOGICAL AND BIOCHEMICAL EFFECT OF RADIATION. 5. INFORMATION ON PLATELET CHANGES AFTER SINGLE AND FRACTIONATED PARTIAL X RADIATION. Hans-Joachim Maurer and Maria Schütz-Sirobej (Universität-Frauenklinik, Erlangen, Ger. and Universität, Bern). Strahlentherapie 110, 197-211(1959). (In German).

Changes of the platelets after a single and fractionated partial irradiation were studied in 32 healthy laboratory animals. It was our intention to find out what type of irradiation was best tolerated by the animals and caused the least damages of the platelets. Principally changes were observed as they occur after unspecific irritation of the organism. After a single partial irradiation with high doses, changes of the platelets are observed. After fractionated irradiation with an interval of 4 days the changes of the platelets are less significant, but they are more significant than the changes of the animals' weight and red cell counts. The mechanism of the reaction is discussed but no explanation given for it. It was proposed to use the platelet count as an index for radiation exposure and for beginning radiation damage. (auth)

2337

EXPERIMENTAL ANIMAL INVESTIGATIONS WITH RADIO PHOSPHOROUS ($Fe^{32}PO_4$). Ernest Kahr and Günther Fasching (Landeskrankenhause, Graz). Strahlentherapie 110, 212-22(1959). (In German)

Artificial radioactive iron phosphate in suspension was injected transdural into the brain of guinea-pigs. Thereafter the local concentration and the removal of the radioactive substance was studied by means of Geiger-Müller counters and autoradiography. Based on these studies radioactive iron phosphate seems to be a suitable substance for infiltration during operation for local irradiation of brain tumors. (auth)

2338

ULTRAFRACTIONATED IONIZING RADIATION AS A BIOPHYSICAL INVESTIGATIVE METHOD. Ansbert Peter Lotz and Klaus Schmidt (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 110, 223-33(1959). (In German)

The ultrafractionated irradiation was defined and the definitions of the parameters involved were given. The possible results of experiments with ultrafractionated irradiation and their connection with the mechanism in question were discussed. The type of dependence of the radiation effect on the pulse frequency is directly related to the dependence of the effect on dose rate at continuous irradiation. The area of the greatest variation of the effect with the frequency is determined in its localization by the average survival time of the units formed primarily by the radiation. The possible models of direct radiation effects with a dependence on dose rate and frequency were mentioned. A possible mechanism of indirect radiation effect was mathematically treated in some detail, and the relations between the dependence on dose rate and frequency, average survival time of free radicals, and starting and fading processes were outlined. It was particularly pointed out that independence of a radiation on dose rate does not necessarily imply the absence of secondary reactions with characteristic time constants. (auth)

Radiation Sickness

2339

THE TRANSPLANTATION OF BLOOD FORMING CELLS IN IRRADIATED ANIMALS. PRESENT STATUS OF THE PROBLEM. G. Doria (Università, Paris). Energia nucleare (Milan) 6, 628-34(1959) Oct. (In Italian)

The hazards of exposure to ionizing radiation are growing larger due to the ever increasing use of nuclear energy. The study and setup of the numerous problems as, e.g., the treatment of irradiated living organisms, is more and more urgent. The current explanation of the recovery of the blood forming cells by means of transplantation of bone marrow cells are surveyed; the physical and biological factors identified as responsible for the acute or delayed mortality following transplantation are examined. The necessity to give the radiobiological research a more definite trend toward the immunology and genetics is pointed out. (auth)

2340

COMPARISON OF PROTECTIVE EFFECTS OF HIND-LEG SHIELDING AND ISOLOGOUS BONE-MARROW INJECTION IN X-IRRADIATED RATS. J. M. Loiselle, L. F. Lamerton, and Kay Adams (Inst. of Cancer Research, Royal Cancer Hospital, London). Intern. J. Radiation Biol. 1, 266-76 (1959) July.

The effect of hind-leg shielding and of the intravenous injection of isologous bone marrow on the radiation response of the young rat has been studied by means of blood counts and by measurement of the uptake of radioactive iron in various tissues. The mechanism of action of the two protective procedures is discussed, particularly with regard to the relative importance of reduced platelet fall and of compensatory erythropoiesis. (auth)

2341

ENZYMATIC ACTIVITY RELATED TO DNA-SYNTHESIS IN REGENERATING LIVER OF IRRADIATED RATS. S. Okada and L. H. Hempelmann (Univ. of Rochester, N. Y.). Intern. J. Radiation Biol. 1, 305-11(1959) July.

The effect of radiation on the DNA-content and on the enzyme responsible for DNA-synthesis has been studied in regenerating rat liver. An almost complete block in the

activity of the DNA-synthesizing enzyme system was observed after irradiation. Some increase was noted in the enzymes concerned with thymidine degradation. These observations are believed to explain to a large degree the depressed DNA-synthesis. (auth)

2342

THE LEUCOCYTIC REACTION IN MICE IMMUNIZED WITH LIVE COMBINED PLAGUE AND TULARAEMIA VACCINE. N. V. Kalacheva (Microbiology and Epidemiology Research Inst. of South-Eastern USSR). J. Microbiol., Epidemiol. Immunobiol. (USSR) (English Translation) 30, No. 1, 56-7(1959).

Results are reported from an experimental analysis of some of the immunological defense mechanisms of the body against the effects of radiation. The influence of previous exposure to a lethal dose of radiation and to certain bacterial toxins was studied in mice. Data are tabulated. It is concluded that the immunological defense mechanisms of the body are of substantial importance in the development of acquired resistance to radiation in warm-blooded animals. Possible reaction mechanisms involved are discussed. (C.H.)

CHEMISTRY

General and Miscellaneous

2343 AECU-4447

Monsanto Chemical Co., Everett, Mass.

ORGANIC COOLANT RECLAMATION. Quarterly Progress Report No. 3 [for] June 15, 1959–September 15, 1959. R. J. Wineman, J. S. Adams, and D. A. Scola. Oct. 15, 1959. 22p. Contract AT(11-1)-705. OTS.

In the third quarter of research on organic coolant reclamation, reaction conditions which show promise as reclamation procedures were found in two major areas of investigation. In the study of hydrocracking of polyphenyls, ten catalysts show activity. One of these, a platinum on alumina, gives a very clean reaction with high conversions per pass and high yields in the model systems under study. The redistribution reaction in the model case of benzene and p-terphenyl gave reproducible results with high enough conversion to be of interest for reclamation. (For preceding period see AECU-4268.) (auth)

2344 AECU-4474

Utah. Univ., Salt Lake City.

PLATE HEIGHT IN GAS CHROMATOGRAPHY. J. Calvin. Giddings, Spencer L. Seager, Larry R. Stucki, and George H. Stewart. [1959]. 18p. OTS.

Equations for description of plate height in gas chromatography are examined with emphasis on the eddy diffusion term. Effects of pressure gradients are also examined. Experimental data using full, half, and quarter columns at high inlet to outlet pressure ratios are presented. The significance of various plate height equations and their parameters can be established from these data. (J.R.D.)

2345 AECU-4477

[Washington Univ., St. Louis.]

FINAL REPORT [ON ELECTRON SPIN RESONANCE SPECTRA OF RADICALS]. [1959]. 6p. Project No. 10. Contract AT(11-1)-85. OTS.

The main effort was devoted to the development of equipment for observation of electron spin resonance spectra of short lived radicals produced by irradiation with ultraviolet and visible light. The photodecomposition and recombination of aromatic hydrocarbons were extensively studied. (W.L.H.)

2346 AERE-C/M-204

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE POSSIBILITY OF FUSED FLUORIDE FUELS FOR HOMOGENEOUS REACTORS. PART II. THE SYSTEMS $KF-PbF_2$ AND ZnF_2-PbF_2. J. K. Dawson, K. Alcock, M. J. East, D. R. Chilton, and A. E. Truswell. Apr. 27, 1954. 6p. (RCTC-P14).

Thermal analyses of the systems $KF-\beta\ PbF_2$ and $ZnF_2-\beta\ PbF_2$ are reported. The former system has a eutectic at 465°C and 33.3 mole % PbF_2, the latter has a eutectic at 590°C and about 60 mole % PbF_2. No compound formation was detected in either system. These temperatures are higher than expected and the systems have no advantages over the $NaF-\beta\ PbF_2$ eutectic investigated previously for use as a reactor fluid. (auth)

2347 AERE-C/M-211

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FUSED FLUORIDE FUEL SYSTEMS FOR HOMOGENEOUS REACTORS, PART III. SYSTEMS OF THE TYPE UF_4-KHF_2. J. K. Dawson, K. Alcock, and M. J. East. June 22, 1954. 5p. (RCTC/P-18).

The solubility of UF_4 and UO_2F_2 was measured in some systems of the type alkali metal fluoride–hydrogen fluoride. The highest solubility observed was 7.4% UF_4 in KHF_2 at 305°C. The eutectic temperature is considerably lower than that attainable in the $NaF-PbF_2-UF_4$ system previously investigated, but this advantage is offset by the considerable decrease in solubility and by the neutron wastage inherent in the change from sodium to potassium. A solution of UF_4 in the $NaF-PbF_2$ eutectic appears to be the most promising fused fluoride fuel system, but even this would require uranium considerably enriched in U 235. (auth)

2348 AERE-C/R-2472(Pt.3)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORTS AND PUBLISHED LITERATURE ON THE ACTINIDE ELEMENTS. (PAPERS DATED 1957 NOTED UP TO JUNE 1958). PART 3. URANIUM. R. W. Clarke, comp. July 1958. 221p. BIS.

Abstracts of reports and published literature on uranium, dated January 1957 and onward are presented. One section comprises abstracts of American, Canadian, British and other unclassified Atomic Energy project reports arranged alphabetically, while a second section consists of abstracts of published literature arranged alphabetically by first named author. Author and subject indexes are also provided. (J.R.D.)

2349 BM-RI-5540

Bureau of Mines.

PREPARATION OF RARE-EARTH CHLORIDE SOLUTIONS. A. C. Rice. Aug. 1958. 13p.

A chemical process for preparing solutions of trivalent rare-earth chlorides from sulfate solutions obtained by treating bastnasite concentrate is described. The chief impurity in the final solution is cerium, and this element is less than 1 percent of the rare-earth oxides. The solution is used directly in the separation of rare-earth elements by ion-exchange methods. The process starts with precipitating the rare-earth hydroxides from sulfate solutions with caustic soda. After the hydroxides are dried to oxidize the cerium, they are treated with dilute hydrochloric acid to dissolve away the trivalent rare-earth elements, leaving the tetravalent cerium. Details for controlling the

leaching step are described. The process shortens older procedures by omitting the usual oxalate or double-sulfate-precipitation step. The cerium in the acid residue is purified by double precipitation as basic nitrate, and the final precipitate is ignited to a 99.9% cerium dioxide. Any trivalent rare-earth elements remaining in the first basic nitrate filtrate are collected by precipitation with caustic soda, and the hydroxides are returned to the main process. (auth)

2350 CCC-454-TR-3I3

Callery Chemical Co., Penna.

THERMODYNAMIC PROPERTIES OF TRIMETHOXYBOROXIN FROM 55° TO 370°K. W. J. Cooper, R. E. Pabst, C. J. Thompson, and J. F. Masi—S. L. Harvey, ed. May 26, 1959. 24p. Project ZIP. Contract NOa(s)-58-454-d.

Measurements of the heat of fusion, triple point, and heat capacity of trimethoxyboroxin from 55 to 370°K are described. Several series of heat capacity measurements were made on the solid phase, each series differing in thermal history of the sample. The saturation heat capacity and derived thermal properties—heat content, entropy and free energy—referred to 55°K, are given at 5° intervals from 55 to 370°K. (auth)

2351 CF-57-12-39(Rev.)

Oak Ridge National Lab., Tenn.

ON THE CHEMISTRY OF THERMONUCLEAR REACTOR BREEDER BLANKETS. Mark T. Robinson. Feb. 7, 1958. 9p. Contract [W-7405-eng-26]. OTS.

In all likelihood, a nuclear power economy based on D-T thermonuclear reactors would require efficient breeding of tritium in blankets around such machines. Some of the chemical aspects of tritium breeder blankets are discussed by application of the principle of electroneutrality. It is shown that the most interesting fertile materials are metallic Li and LiD, although there are no serious bars to the use of many other materials. If neutron multiplication be employed, it appears necessary to use elemental Be due to the extensive decomposition that will be encountered in Be compounds. (auth)

2352 CF-59-11-27

Oak Ridge National Lab., Tenn.

EFFECT OF EXCESS ACID ON TWO-LIQUID-PHASE TEMPERATURE LIMITS FOR THE HOMOGENEOUS REACTOR FUEL SOLUTION AND ITS CONCENTRATES. R. E. Moore and W. L. Marshall. Nov. 9, 1959. 12p. Contract [W-7405-eng-26]. OTS.

Temperatures are given at which a second liquid phase forms in synthetic homogeneous reactor fuel solutions containing 0.0166, 0.0234, 0.0308, and 0.0413 molar excess acid and concentrates of these solutions. The result is a two-liquid-phase temperature-concentration factor curve for each original solution with minimum temperatures of 305, 322, 330, and 342°C. The minimum temperatures are considered significant in reactor operation. The theory is that if the pressurizer temperature is held below the minimum, concentration of the fuel in the core will not result in formation of the second liquid phase with consequent reactor operational instability. Interpolated two-liquid-phase temperature-concentration factor curves for excess acid concentrations between those of the experimental solutions are presented to serve as a guide to the selection of an optimum quantity of acid to be added to the present HRE-2 fuel (0.0166 molar excess acid) to achieve greater phase stability. (auth)

2353 CNLM-1802-2

Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.

PURIFICATION OF ARGON, HELIUM, AND XENON. A Bibliography. E. A. Cernak, comp. Sept. 16, 1959. 19p.

This bibliography contains 145 references on the technology and apparatus used in the purification of argon, helium, and xenon, and on the analyses for water, carbon monoxide, hydrogen, nitrogen, and oxygen in the purification process. The references are arranged in chronological order and in four classifications, general, argon, helium, and xenon. The sources used in compiling this bibliography include Applied Science and Technology Index, 1958–July 1959; Chemical Abstracts, 1937–Aug. 1959; Engineering Index, 1950–1958; Industrial Arts Index, 1945–1957; and Nuclear Science Abstracts, 1948–Aug. 1959. (auth)

2354 DF-58-AGT-111 and Add.

General Electric Co. Aircraft Gas Turbine Div., Evendale, Ohio.

COLLECTED THERMODYNAMIC PROPERTIES OF EIGHTY-EIGHT POSSIBLE PRODUCTS OF REACTION. Eugene A. Mickle. Dec. 10, 1957. 195p. ADDENDUM. Joanne S. Lawrence and Eugene A. Mickle. Oct. 1958. 75p.

This report and addendum were issued separately, but are cataloged as a unit.

A collection of thermodynamic properties of the most common reaction products encountered in rocket applications is presented. Only those properties that are essential for the calculation of the composition and thermodynamic properties of the products of a reaction at equilibrium are included, such as the Gibbs free energy, the enthalpy, and the heat capacity at constant pressure. These properties are tabulated at 100° intervals at 300 to 6000°K inclusive when complete data for this range could be found in the literature. (auth)

2355 MSAR-59-127

MSA Research Corp., Callery, Penna.

PHYSICAL AND CHEMICAL PROPERTIES OF POTASSIUM TETRABORATE. Technical Report 68. S. J. Rodgers. Nov. 18, 1959. 12p. Contract NObs-77023.

Conductivity measurements can be used to determine $K_2B_4O_7 \cdot 4H_2O$ concentration in water over the range of 2 to 5000 ppm. Use of conductivity measurements to determine concentration of $K_2B_4O_7 \cdot 4H_2O$ in LiOH solutions (pH 10.5 to 11.0) and in NH_4OH solution (pH 8.5 to 9.3) is limited by the inherent conductivity of the alkaline solutions. Solubility of $K_2B_4O_7 \cdot 4H_2O$ in water was studied over the temperature range of 40 to 200°F giving results ranging from 10 to 64 wt. %. Solution rates under conditions of mild agitation were investigated as a function of temperature and concentration and were found to be relatively high, 90% of saturation amount dissolving in 100 sec at 120°F. It was found that $K_2B_4O_7 \cdot 4H_2O$ in solution did not undergo decomposition in two weeks at 630°F in water. The manufacturer indicates that it is stable in air at this temperature but becomes completely anhydrous at 725°F. (auth)

2356 NAA-SR-Memo-2671

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

LATENT HEAT OF VAPORIZATION AND VAPOR PRESSURE DATA FOR ORGANIC COOLANTS. R. W. Burkhardt. Apr. 17, 1958. 14p. OTS.

In order to estimate the performance of flash distillation equipment for the purification of organic coolants, heat of vaporization and vapor pressure data for the coolant components are needed. Heat of vaporization data for isopropyl diphenyl, orthoterphenyl, metaterphenyl, paraterphenyl, and diphenyl at absolute pressures of four, two, one and one-

half inches of mercury were obtained. The corresponding equilibrium temperatures provided additional vapor pressure data. The data were correlated for interpolation and limited extrapolation, and for estimation of the vapor pressure and heat of vaporization of Santowax R. (auth)

2357 NAA-SR-Memo-3130
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE PRESENCE OF ARGON IN TERPHENYL. L. B. Gardner and R. L. Koontz. Dec. 31, 1958. 6p. OTS.

An experimental determination of Ar^{41} activity in irradiated OMRE terphenyl was made. Argon-41 was positively identified in both fresh and main loop samples of terphenyl. (W.L.H.)

2358 NAA-SR-Memo-3223
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE PROPERTIES OF SANTOWAX-R (MIXED TERPHENYL ISOMERS) AS ORGANIC MODERATOR-COOLANT. R. H. J. Gercke, F. C. Silvey, and G. Asanovich. [1959?]. 76p. OTS.

The properties of mixed isomeric terphenyls were assembled to make available to those concerned with the organic reactor concept a single source of evaluated information on this organic coolant. Values for 31 physical, chemical, and electrical properties are given wherever possible as a function of temperature and extent of radiolytic decomposition. Many of the properties were determined experimentally, while others are the result of new correlation or calculation techniques. Whenever possible, all available sources are compared and evaluated. (auth)

2359 NAA-SR-Memo-3652
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DEGASIFICATION OF NITROGEN FROM SANTOWAX R. G. W. Corporales and P. R. Benson. Mar. 19, 1959. 12p. OTS.

The rate of degasification of N_2 from monisopropyl diphenyl and from Santowax R was studied to determine the effects of various parameters on the vacuum degasification process. The effects of pressure, temperature, feed rate, and spray nozzle type and size were determined. (W.L.H.)

2360 NAA-SR-Memo-3797
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HYDROGEN DENSITY OF POLYPHENYL ORGANIC COOLANTS. R. T. Keen and R. A. Baxter. May 5, 1959. 16p. OTS.

The moderating properties of organic coolants are directly related to the hydrogen density of the coolant material. Studies were performed to determine the hydrogen density of four polyphenyl materials as a function of temperature and decomposition. The hydrogen densities at 600°F were calculated from coolant densities. Graphs of the carbon to hydrogen atom ratios and hydrogen densities as a function of % high boiler for the four in-pile loop materials are shown. It is shown that hydrogen density increases with decomposition even though hydrogen is lost. Graphs of the hydrogen density versus temperature for isopropyl diphenyl, diphenyl, ⅔ ortho-, ⅓ meta-terphenyl, and Santowax-R are shown. (W.L.H.)

2361 NAA-SR-Memo-3816
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
A MICRO METHOD FOR THE DETERMINATION OF THE HIGH BOILERS FRACTION IN OMRE COOLANT. M. A. Rotheram. Apr. 30, 1959. 8p. OTS.

Studies were performed to develop a method for total high boilers (HB) determination which is suitable for small samples of OMRE coolant and for samples which contain small amounts of high boilers. For samples containing less than 6% HB, the standard deviation is 0.6% absolute. For samples containing larger amounts of HB, the standard deviation is 1% absolute. (W.L.H.)

2362 NAA-SR-Memo-4129
Atomics International Div., North American Aviation Inc., Canoga Park, Calif.
ADSORPTION OF DIPHENYL VAPORS IN THE PRESENCE OF STEAM. H. M. Gilroy. July 27, 1959. 9p. OTS.

The effect of steam and water vapor on the efficiency and adsorptive capacity of the activated carbon adsorber in the Piqua waste gas system was studied. Results show that the presence of steam and water vapor had no effect on the adsorption of diphenyl vapors by activated carbon at the conditions studied. (W.L.H.)

2363 NBL-156
New Brunswick Lab., AEC, N. J.
SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JANUARY 1959 THROUGH JUNE 1959. C. J. Rodden. Oct. 1959. 63p. OTS.

The potentiometric determination of Pu using National Bureau of Standards potassium dichromate is described. A potentiometric method is reported for the determination of U_3O_8 in UO_3. The resolution and sensitivity of an alpha particle spectrometer for U^{234} and U^{236} were determined. Three methods for the preparation of BF_3 are reported for mass spectrometer analysis. A thermogravimetric study of the composition of U_3O_8 was performed. Microgram quantities of Pu were separated from laboratory waste effluents by cation exchange. (W.L.H.)

2364 NP-8045
Purdue Univ., Lafayette, Ind.
THE ARC SPECTRUM OF CESIUM. Technical Report No. 1. H. Kleiman and K. W. Meissner. Oct. 1959. 39p. Contract Nonr-1100(08).

Precision measurements have been made on sixty-three lines in the arc spectrum of cesium. In particular the first three members of the principal series have been measured interferometrically for the first time, allowing improvement in the level scheme. Comparison has been made of the wavelengths emitted by two different light sources, a Geissler tube and an Electrodeless Discharge lamp, and a relative shift has been found in the high members of the fundamental series. This makes it even now desirable to develop an atomic beam light source which one hopes will be free of perturbations. The term values found in this investigation have been fitted to extended Ritz type formulas with fair accuracy. The polarization formula has been used to fit the fundamental series. (auth)

2365 NRL-5383
Naval Research Lab., Washington, D. C.
METALS COATED WITH FILMS OF LOW SURFACE ENERGY AS REFERENCE ELECTRODES FOR THE MEASUREMENTS OF CONTACT POTENTIAL DIFFERENCES. K. Bewig and W. A. Zisman. Aug. 3, 1959. 14p. Project NR 472-000.

The central problem in the measurement of the contact potentials of solid and liquid surfaces in gaseous atmospheres is the stability of the contact potential of the reference electrode to which the potential difference between the two is referred. Noble metals, such as gold or platinum,

are usually employed as reference electrodes, but, in gaseous atmospheres, their contact potentials can change significantly because of vapor adsorption on the reference surfaces. This occurs even on aged metals, the effect of adsorbed water vapor being especially great. But a metal which has been coated with a low-energy film, such as Teflon or FEP Teflon resin, exhibits little change in the contact potential in a wide variety of polar and nonpolar vapors. This is demonstrated by the results of recent studies of metals in a nitrogen atmosphere in which the water-vapor content was varied from 1% to as high as 91% R.H. Teflon-coated metal reference electrodes have proved to be remarkably stable under these conditions. (auth)

2366 NRL-5393
Naval Research Lab., Washington, D. C.
TAUTOMERISM IN PHOSPHORUS CHEMISTRY. PART III. HYDROGEN ISOTOPE EXCHANGE IN PHENYLPHOSPHINIC ACID AND ITS ANION. R. B. Fox. Aug. 19, 1959. 12p. Project NR 474-000.

Parts I and II issued as NRL-5242 and NRL-5335, respectively.

A study was made of prototropy in the P(O)H system as found in phenylphosphinic acid. Hydrogen isotope exchange was used as a measure of the extent to which prototropy may occur in such phosphorus derivatives. In aqueous solutions, the exchange was found to be both acid- and base-catalyzed, with a prototropic equilibrium probably governing the rate of the acid-catalyzed reaction. Exchange takes place to only a negligible extent in buffered neutral solutions over periods up to six weeks, which makes unlikely a termolecular attack as a significant factor in the mechanism of the reaction. A comparison of exchange rates with those found in aqueous acetone solutions indicates that the proportions of enol in both systems is of the same order of magnitude. (auth)

2367 NRL-5394
Naval Research Lab., Washington, D. C.
CONSTITUTIVE RELATIONS IN THE WETTING OF LOW-ENERGY SURFACES AND THE THEORY OF THE RETRACTION METHOD OF PREPARING MONOLAYERS. Elaine G. Shafrin and W. A. Zisman. Aug. 19, 1959. 14p. Project NR 472-000.

Earlier systematic studies of the angle of contact θ exhibited by drops of liquid on plane, solid surfaces of low surface energy revealed a regular linear variation in cos θ with the surface tension (γ_{LV}) of a large variety of liquids. This led to the concept of the critical surface tension of spreading (γ_c) and its use in characterizing the wettability of organic solids and of high-energy surfaces coated with adsorbed organic films. The wetting properties of low-energy organic surfaces are shown to depend upon the chemical structure and the physical packing of the atom groups in the outermost layer. For hydrocarbons, wettability decreases with increasing hydrogenation. Fluorine is the most effective hydrogen substitute in decreasing γ_c, whereas Cl, Br, I, O, and N increase the wettability of organic surfaces. The "retraction method" of preparing monomolecular films from solutions on solids is shown to be a direct consequence of the above constitutive law of wetting. The same analysis, applied to a pure liquid, results in the explanation of the behavior of the autophobic liquids at room temperature and of the process of depositing a monolayer on a solid by retraction from the melt over a range of temperature. (auth)

2368 NYO-2916
Rutgers Univ., New Brunswick, N. J.
ANALYTICAL CHEMISTRY OF THE POLYPHOSPHATES. [Period covered]: July 16, 1958 to September 30, 1959. William Rieman, III. 18p. Contract AT(30-1)-1306. OTS.

A method for the analysis of mixtures of the lower condensed phosphates which would permit the determination of each linear phosphate up to and including undecaphosphate and the common cyclic phosphates was developed. The method should be applicable to mixtures that contain all of these compounds plus the higher polymers. The approach to this problem was by the technique of ion exchange chromatography. A method was developed for the determination of the molecular-weight distribution of Graham salt. (J.E.D.)

2369 OOR-1543.16
Chicago, Univ.
MASS SPECTROMETRY APPLIED TO HIGH TEMPERATURE CHEMISTRY. Technical Report No. 11. Period covered: Review to July 15, 1959. Mark G. Inghram and Jean Drowart. 44p. OOR Project No. 1543. Contract DA-11-022-ORD-1993.

A summary of mass spectrometric techniques in high-temperature chemistry is presented. Uses and limitations of the method are discussed and results of vaporization tests are tabulated. A section is also included to suggest a number of additional applications. (J.R.D.)

2370 ORNL-2749
Oak Ridge National Lab., Tenn.
SOLUBILITY RELATIONS AMONG RARE-EARTH FLUORIDES IN SELECTED MOLTEN FLUORIDE SOLVENTS. W. T. Ward, R. A. Strehlow, W. R. Grimes, and G. M. Watson. Nov. 16, 1959. 14p. Contract W-7405-eng-26. OTS.

Solubility measurements of rare-earth and yttrium fluorides were made in various solvents containing zirconium or beryllium fluoride with certain alkali-metal fluorides, and in some cases uranium fluoride, present. Tests were performed which pertain to the development of a method of removal of rare earth fluoride nuclear poisons from certain mixtures of interest to the Molten Salt Power Reactor Program. The method is shown to be effective in several concentration ranges. (auth)

2371 ORNL-2824
Oak Ridge National Lab., Tenn.
ELECTROLYTIC DISINTEGRATION OF ZIRCALOY-2 IN NITRIC ACID SOLUTIONS. Walter E. Clark and Sigfred Peterson. Nov. 27, 1959. 18p. Contract W-7405-eng-26. OTS.

Zircaloy-2 is anodically converted to scaly ZrO_2 at 60°C in 8 M HNO_3. About 0.5 mole of acid is consumed per faraday, and after saturation of the electrolyte with nitrogen oxides about 0.3 mole of gas is evolved per faraday. The nitric acid is reduced to hydrogen, NO, and NO_2, with hydrogen predominating if the cathode is Zircaloy and NO if the cathode is platinum. Corrosion specimens of HRT metals were exposed to the electrolysis conditions. From determinations of the decomposition potential of nitric acid it appears that a metal container for the electrolytic process can be protected from stray-current corrosion by holding it at a potential ~0.5 volt positive to a platinum cathode operating at a current density of 5 to 10 ma/cm^2. Practical laboratory experiments tended to confirm this conclusion. (auth)

2372 ORNL-2836
Oak Ridge National Lab., Tenn.
MICRO-ELECTROPHORETIC DETERMINATION OF THE ZETA POTENTIAL OF THORIUM OXIDE. C. M. Boyd, H. P. House, and Oscar Menis. Nov. 27, 1959. 22p. Contract W-7405-eng-26. OTS.

A micro-electrophoresis cell is described, and its application to the determination of the zeta potential of thorium oxide is presented. Samples of thorium oxide from different sources, some of which were subjected to certain physical treatments, are characterized by the zeta potential obtained in water. The zeta potentials produced in solutions of HCl, H_2SO_4, KOH, NaOH, $Na_4P_2O_7$, and Na_3PO_4 are also given. (auth)

2373 UCRL-8906

California. Univ., Berkeley. Lawrence Radiation Lab. THE CRYSTAL STRUCTURES OF SEVERAL ORGANIC COMPOUNDS (thesis). Frederick J. Strieter. Sept. 18, 1959. 39p. Contract W-7405-eng-48. OTS.

The structure of the 1-1 addition compound of carbon tetrabromide and para-xylene ($CBr_4 \cdot CH_3-C_6H_4-CH_3$) was determined by three-dimensional single-crystal x-ray-diffraction techniques. The compound crystallizes in an orthorhombic unit cell with the dimensions a = 8.476 ± 0.03, b = 8.894 ± 0.03, c = 17.465 ± 0.05A. Each aromatic ring has two bromine atoms, one on each side, at a distance of 3.34 ± 0.02A from the center of the ring. The average distance from the bromine atom to the carbon atoms of the aromatic nucleus is 3.62 ± 0.02A. According to single crystal three-dimensional x ray data, propionic acid crystals at −95°C have monoclinic symmetry, space group $P2_1/c$ (C_{2h}^5), with a = 4.042 ± 0.040, b = 9.063 ± 0.010, c = 10.998 ± 0.010A, and β = 91°15′ ± 8′. Propionic acid forms are nearly planar dimers in the solid, with an O-H—O bond of 2.645A, a C = O bond of 1.230A, a C = O bond of 1.313A, and C−C bonds of 1.499A and 1.522A, all with standard deviations of less than ±0.010A. Accoı ding to a single crystal x-ray analysis of three-dimensional data at −43°C, n-butyric acid crystallizes in a monoclinic space group, $C2/m$, with the unit cell dimensions a = 8.014 ± 0.080A, b = 6.815 ± 0.020A, c = 10.145 ± 0.030A, and β = 111°27′ ± 15′. Within experimental error, two molecules are hydrogen bonded together to form a planar dimer which is perpendicular to the b axis. The structure gives a hydrogen bond 2.63A long, a C=O bond of 1.19A, a C−O bond of 1.34A, and C−O bonds of 1.48A, 1.52A and 1.49A, all with standard deviations of less than ±0.02A. (auth)

2374 AEC-tr-3898

THE STRUCTURE DETERMINATION OF ORGANIC COMPOUNDS. Sumio Umezawa. Translated for Los Alamos Scientific Lab. from Bunseki Kagaku 8, 471-84(1959). 40p. JCL.

Methods of determining the structure of organic compounds are investigated. The application of physical measurements is discussed along with general procedures of structure determination, and the structural relationships of natural products. Examples of recent structure determinations are included. (J.R.D.)

2375

REACTIONS OF RADICALS IN THE PRESENCE OF THALLIUM (I) IONS. II. USE OF THALLIUM (I) SULFATE IN A DOSIMETER WITH IRON (II) SULFATE. J. Bednář (Militartechnische Akademie, Brno). Collection Czechoslov. Chem. Communs. 24, 2803-7(1959) Aug. (In German)

Ferrous sulfate solutions with various additions of Tl_2SO_4 were irradiated and analyzed. The presence of Tl^+ at sufficiently high proportions of $[Fe^{2+}]$ to $[Fe^{3+}]$ has no influence on the oxidation of Fe^{2+} with H_2O_2. The Tl_2SO_4 exerts an effect similar to that of NaCl. A stronger action resulted in the presence of ethylene. Provided the dosimetric solution contains no appreciable Fe^{3+} ion excess at the beginning, the Fe^{2+} ions can be protected from undesirable oxidation by organic peroxides by the presence of 10^{-3} M Tl^+. (T.R.H.)

2376

STUDY OF THE REACTION KINETICS OF ELECTRODE PROCESSES BY MEANS OF ELECTROLYSIS AT CONSTANT CURRENT. I. STUDY OF THE DISMUTATION OF THE PENTAVALENT URANIUM ION. O. Fischer and O. Dračka (Masaryk-Universität, Brno). Collection Czechoslov. Chem. Communs. 24, 3046-56(1959) Sept. (In German)

An equation was derived which makes possible the calculation of the dismutation velocity constant using the transition time for electrolysis at constant current. The proposed relationship $i\tau^{1/2} - i^{1/2}$, which is characteristic for the dismutation of electrode products by this method, was experimentally checked for the case of UO_2^{2+} reduction. The limit of applicability of the proposed method was determined for higher and lower dismutation rates. The measurements were carried out with a stationary drop electrode and a shallow mercury electrode in chloride and perchlorate media at different pHs under constant ionic strength. The average value of rate constant reduced to pH 1 ($k_0 = k/H^+$) was 260 $mole^{-2}\ l^2 s^{-1}$ for 0.5 M Cl^-, 980 for 2 M Cl^-, 195 for 0.5 M ClO_4^-, and 420 for 2 M Cl_4^-. The results were compared with the polarographically measured values. (tr-auth)

2377

PREPARATION OF URANYL CARBONATE. J. Čejka. Collection Czechoslov. Chem. Communs. 24, 3180-81 (1959) Sept. (In German)

A $UO_2(NO_3)_2 \cdot 6H_2O$ solution was reacted with ethanol to produce $U_3O_8 \cdot xH_2O$. This was then heated in air and CO_2 to produce UO_2CO_3 which analyzed 86.18% UO_3 and 12.53% CO_2. (T.R.H.)

2378

ISOTOPIC EFFECT ON THE ASSOCIATION ENERGIES OF SOME ALCOHOLS AND PHENOLS. Robert Cardinaud (École Centrale des Arts et Manufactures, [France]). Compt. rend. 249, 1641-3(1959) Oct. 28. (In French)

The energies of the hydrogen bond of some ordinary and deuterated alcohols and phenols in various solutions were calculated by an approximation formula which gave good agreement with experimental results. The systems studied included methanol−carbon tetrachloride, phenol−carbon tetrachloride, p-nitrophenol−carbon tetrachloride, o-nitrophenol−carbon tetrachloride, o-nitrophenol−dioxane−carbon tetrachloride, p-nitrophenol−dioxane−carbon tetrachloride, methanol−benzene, and propanol. A correlation between the isotopic effect on this energy and the electron structure of the association complexes is indicated. (tr-auth)

2379

VAPOR PRESSURE MEASUREMENT WHEN THE VAPOR IS IN EQUILIBRIUM WITH SOLID BERYLLIUM OXIDE. L. P. Belykh and A. N. Nesmeyanov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 128, 979-80 (1959). (In Russian)

Measurements were made of the equilibrium vapor pressure of solid beryllium oxide at 2103 to 2573°K. The measurements were carried out by evaporation from an open surface in a vacuum and by an integral variation of the effusion method. (R.V.J.)

2380

RARE-EARTH POLYMORPHISM AND PHASE EQUILIBRIA IN RARE-EARTH OXIDE−WATER SYSTEMS. M. W. Shafer and Rustum Roy (Pennsylvania State Univ., University Park). J. Am. Ceram. Soc. 42, 563-70(1959) Nov.

A high-water-pressure high-temperature study was conducted of the systems $Y_2O_3-H_2O$, $Sm_2O_3-H_2O$, $Nd_2O_3-H_2O$,

and $La_2O_3-H_2O$. The trihydroxides $La(OH)_3$, $Nd(OH)_3$, and $Sm(OH)_3$ are isomorphous, but $Y(OH)_3$ does not belong to this group. On the other hand, the oxyhydroxides YOOH, SmOOH, and NdOOH are isomorphous; LaOOH, if it exists, cannot be stable in the presence of water at room temperature. Pressure-temperature curves for the equilibrium between the trihydroxide, oxyhydroxide, and a new hydroxy compound were determined for each of the three smaller ions. The reversibility of the transition between the A-, B-, and C-type rare earths was established, and new x-ray data on the B structure are listed. The relations between the polymorphs as a function of ionic size are changed from those given by Goldschmidt. The very marked difference in stability in air between the A- and C-type structures suggests the obvious desirability of converting rare-earth oxide ceramics into the C structure with proper compositional variation and thermal treatment. (auth)

2381

STEREOCHEMISTRY OF BASE-CATALYZED HYDROGEN–DEUTERIUM EXCHANGE REACTIONS. Donald J. Cram, Charles C. Kingsbury, and Bruce Rickborn (Univ. of California, Los Angeles). J. Am. Chem. Soc. 81, 5835 (1959) Nov. 5.

Hydrogen–deuterium exchange and reverse reactions occurred with high net retention in tert-butyl alcohol, and with racemization in dimethyl sulfoxide. (C.J.G.)

2382

NEUTRON-DIFFRACTION STUDY OF ANTIFERROMAGNETIC $FeTiO_3$ AND ITS SOLID SOLUTIONS WITH $\alpha-Fe_2O_3$. G. Shirane (Westinghouse Research Labs., Pittsburgh); S. J. Pickart (Naval Ordnance Lab., White Oak, Md. and Brookhaven National Lab., Upton, N. Y.); R. Nathans (Pennsylvania State Univ., University Park and Brookhaven National Lab., Upton, N. Y.); and Y. Ishikawa (Univ. of Tokyo). Phys. and Chem. Solids 10, 35-43(1959) Apr.

While $FeTiO_3$ and α-Fe_2O_3 are both antiferromagnetic, some solid solutions of the two possess strong magnetic moments which are believed to be related to an ordering of the Fe and Ti atoms. Neutron powder patterns confirm the x-ray picture of $FeTiO_3$ as alternating layers of Fe and Ti along the [1 1 1] axis of the rhombohedral cell with intervening oxygen layers, and provide more accurate oxygen parameters. Data taken below the Néel point of 68°K suggest a model for the spin structure in which Fe^{2+} moments are ferromagnetically coupled within a (1 1 1) sheet and directed perpendicular to it. Studies on the solid solutions connect the presence of the spontaneous moment with ordering of the Ti and Fe atoms, and show that the spin arrangement in most of these compositions is of the α-Fe_2O_3 type with spins ferromagnetically coupled and lying within (1 1 1) sheets. The fact that no long-range ordered spin structure is observed down to 4.2°K for the sample containing 12% hematite can be explained on the basis of an inhomogeneous magnetic structure. (auth)

2383

THE CATALYTIC ACTIVITY OF SILVER CRYSTALS OF VARIOUS ORIENTATIONS AFTER BOMBARDMENT WITH POSITIVE IONS. H. M. C. Sosnovsky (Univ. of Melbourne). Phys. and Chem. Solids 10, 304-10(1959) Aug.

Single crystals of silver with surfaces oriented parallel to (111), (110), and (100) have been bombarded with positive argon ions at voltages between 14 and 4000 v. The catalytic decomposition of formic acid has been used as a test reaction in the temperature range 150 to 250°C. The parameters log A and E found from Arrhenius plots change appreciably with bombarding ion energy and for each ion energy are different for the three orientations. It is concluded that the reaction occurs at sites where dislocation lines intersect the surface and that a compensating effect occurs which is associated with interaction between dislocations when their density is high. (auth)

2384

NATURE OF THE CHEMICAL BOND IN CRYSTALLINE LiH. Z. G. Pinsker and R. N. Kurdiumova (Inst. of Crystallography, Academy of Sciences, USSR). Soviet Phys. – Cryst. 3, 503-5(1958) July-Aug.

The structure of LiH in polycrystalline films made by vacuum sublimation of the powdered hydride on celluloid films was studied. The intensities I_e of 18 reflections up to 622 with d = 0.615 were determined microphotometrically from diffraction patterns with the aid of blackening curves. (C.J.G.)

2385

ELECTRON-DIFFRACTION STUDIES OF THE MOLECULAR STRUCTURE OF Ga, Y, La, AND NEODYMIUM HALIDES. P. A. Akishin, V. A. Naumov, and V. M. Tatevskiĭ. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 1, 229-36(1959). (In Russian)

Electron-diffraction studies were made of the molecular structures of tri- and hexavalent gallium, lanthanum, neodymium, and yttrium halides in the gaseous phase. The regularities observed in molecular structures are discussed. (R.V.J.)

2386

ON THE PRODUCTS OF NIOBIUM PENTOXIDE AND TANTALUM PENTOXIDE REACTION WITH CAUSTIC ALKALI. A. V. Lapitskiĭ. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 121-6(1959). (In Russian)

The products of niobium pentoxide and tantalum pentoxide reactions with caustic soda and caustic potassium were studied. Reactions of tantalum with caustic soda solutions form various hydrous tantalates (sodium orthotantalate, pentatantalate, and hexatantalate) depending on the concentration of the initial alkali solutions. The refraction indices of sodium penta- and hexatantalates are verified and the refraction index for sodium orthotantalate is determined. The processes of aqueous decomposition of molten alkali containing niobium and tantalum are studied and the mechanism of hydrolytic fracturing of high-alkali niobates and tantalates are analyzed. (R.V.J.)

2387

SPECTROPHOTOMETRIC INVESTIGATION OF COMPLEX SAMARIUM COMPOUNDS WITH CITRIC, LACTIC, AND TRIOXIGLUTARIC ACIDS. M. I. Gromova, I. F. Varaskina, and V. M. Peshkova. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 171-9 (1959). (In Russian)

The range of pH values for various samarium complexes with citric acid, lactic acid, and trioxiglutaric acid was determined spectrophotometrically. Two complex compounds of samarium with citric acid and with trioxiglutaric acid and one with lactic acid (in acid region) were observed in the pH interval 1 to 12. It was shown that the complexes with citric acid are of the same order of stability as complexes with trioxiglutaric acid and are considerably more stable than complexes with lactic acid. (R.V.J.)

2388

DISSOCIATION PRESSURE OF SODIUM FLUOBERYLLATE Na_2BeF_4. A. V. Novoselova, F. Sh. Muratov, L. P. Reshetnikova, and I. V. Gordeev. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 181-90 (1959). (In Russian)

Thermal dissociation of fluoberyllate Na_2BeF_4 was studied at 1009 to 1197°C, and the vapor pressures of beryllium fluoride at 762 to 1103°C and sodium fluoride liquid at 1073 to 1193°C were determined. The data show that complex molecules of $NaBeF_3$ exist over the melted sodium fluoberyllate Na_2BeF_4. (R.V.J.)

2389

SORPTION OF HYDROGEN BY TITANIUM AND ZIRCONIUM AT LOW PRESSURES. E. A. Ab, R. I. Plotnikov, and L. A. Khutsishvili. Zhur. Tekh. Fiz. 29, 1146-51 (1959) Sept. (In Russian)

Measurements were made of the quantity and rate of hydrogen sorption under low pressures by ductile, sublimated, and powdered titanium and zirconium. It was revealed that fast hydrogen sorption begins at room temperature achieving the maximum adsorption by titanium and zirconium powders at 150 to 200°C. At 10^{-6} to 10^{-3} mm mercury pressure the rate of sorption does not react to pressure. Effective sorption coatings were developed for efficient pumping of hydrogen from vacuum apparatuses. (R.V.J.)

2390

NEW METHOD FOR THE OBTENTION OF CARRIER-FREE IODINE-132 FROM TELLURIUM-132 FOR MEDICAL PURPOSES. (to Farbwerke Hoechst Aktiengesellschaft vormals Meister Lucius and Brüning). German Patent DAS 1045 596. Dec. 4, 1958. Atompraxis 5, 330(1959). (In German)

The principle of the method proposed is the enrichment of Te^{132} so that the I^{132} can be obtained in a pure form without contamination with uranium or plutonium fission products. An acid solution containing Te and other metal ions which can be precipitated with ammonia, is adsorbed on a hygroscopic material. The solution is treated with ammonia and the I^{132}, formed by the Te^{132} adsorbed on the hydroxide, is rinsed out with sodium chloride solution. (J.S.R.)

2391

PLATINUM HEXAFLUORIDE AND METHOD OF FLUORINATING PLUTONIUM CONTAINING MIXTURES THEREWITH. J. G. Malm, B. Weinstock, and H. H. Claassen (to U. S. Atomic Energy Commission). U. S. Patent 2,893,826. July 7, 1959.

The preparation of platinum hexafluoride and its use as a fluorinating agent in a process for separating plutonium from fission products is presented. According to the invention, platinum is reacted with fluorine gas at from 900 to 1100°C to form platinum hexafluoride. The platinum hexafluoride is then contacted with the plutonium containing mixture at room temperature to form plutonium hexafluoride which is more volatile than the fission products fluorides and therefore can be isolated by distillation.

2392

PREPARATION OF PLUTONIUM. M. Kolodney (to U. S. Atomic Energy Commission). U. S. Patent 2,893,928. July 7, 1959.

Methods are presented for the electro-deposition of plutonium from fused mixtures of plutonium halides and halides of the alkali metals and alkaline earth metals. The salts, preferably chlorides and with the plutonium preferably in the trivalent state, are placed in a refractory crucible such as tantalum or molybdenum and heated in a non-oxidizing atmosphere to 600 to 850°C, the higher temperatures being used to obtain massive plutonium and the lower for the powder form. Electrodes of graphite or non-reactive refractory metals are used, the crucible serving as the cathode in one apparatus described in the patent.

2393

COATING URANIUM FROM CARBONYLS. D. H. Gurinsky and S. S. Storrs (to U. S. Atomic Energy Commission). U. S. Patent 2,894,320. July 14, 1959.

Methods are described for making adherent corrosion resistant coatings on uranium metal. According to the invention, the uranium metal is heated in the presence of an organometallic compound such as the carbonyls of nickel, molybdenum, chromium, niobium, and tungsten at a temperature sufficient to decompose the metal carbonyl and dry plate the resultant free metal on the surface of the uranium metal body. The metal coated body is then further heated at a higher temperature to thermally diffuse the coating metal within the uranium body.

2394

METHOD FOR DETERMINING THE STABILITY OF FLUOROCARBON OILS. Z. D. Sheldon and H. M. Haendler (to U. S. Atomic Energy Commission). U. S. Patent 2,895,806. July 21, 1959.

A method of determining the stability of a fluorocarbon oil to uranium hexafluoride is presented. The method comprises reacting a weighed sample of the oil with condensed uranium hexafluoride in a reaction zone and titrating the amount of uranium tetrafluoride produced with potassium dichromate.

2395

PROCESS FOR MAKING URANIUM HEXAFLUORIDE. R. Rosen (to U. S. Atomic Energy Commission). U. S. Patent 2,894,811. July 14, 1959.

A process is described for producing uranium hexafluoride by reacting uranium hexachloride with hydrogen fluoride at a temperature below about 150°C, under anhydrous conditions.

2396

METHOD OF APPLYING COPPER COATINGS TO URANIUM. A. G. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,894,885. July 14, 1959.

A method is presented for protecting metallic uranium, which comprises anodic etching of the uranium in an aqueous phosphoric acid solution containing chloride ions, cleaning the etched uranium in aqueous nitric acid solution, promptly electro-plating the cleaned uranium in a copper electro-plating bath, and then electro-plating thereupon lead, tin, zinc, cadmium, chromium or nickel from an aqueous electro-plating bath.

2397

METHOD OF PREPARING COATED REFRACTORY WARE. M. L. Perlman, D. Lipkin, and S. I. Weissman (to U. S. Atomic Energy Commission). U. S. Patent 2,895,849. July 21, 1959.

A method is presented for preparing a dense, refractory coating on a vessel adapted to the handling of molten metals such as uranium and plutonium. According to the invention, the inner surface of a heat stable container formed of a refractory metal of either niobium, molybdenum, tantalum, or tungsten is coated with molten thorium within 10 minutes so as to present alloying with the refractory metal and then exposed to a reactive atmosphere of nitrogen at a temperature of about 1750° for 30 minutes to form a refractory thorium nitride coating.

2398

PRODUCTION OF URANIUM TETRAFLUORIDE. W. E. Shaw, R. M. Spenceley, and F. M. Teetzel (to U. S. Atomic Energy Commission). U. S. Patent 2,898,187. Aug. 4, 1959.

A method is presented for producing uranium tetrafluoride from the gaseous hexafluoride by feeding the hexa-

fluoride into a high temperature zone obtained by the recombination of molecularly dissociated hydrogen. The molal ratio of hydrogen to uranium hexafluoride is preferably about 3 to 1. Uranium tetrafluoride is obtained in a finely divided, anhydrous state.

2399
REMOVAL OF CHLORIDE FROM AQUEOUS SOLUTIONS. W. W. Schulz (to U. S. Atomic Energy Commission). U. S. Patent 2,898,203. Aug. 4, 1959.

The removal of chlorides from aqueous solutions is described. The process involves contacting the aqueous chloride containing solution with a benzene solution about 0.005 M in phenyl mercuric acetate whereby the chloride anions are taken up by the organic phase and separating the organic phase from the aqueous solutions.

2400
METHOD OF FIXING NITROGEN FOR PRODUCING OXIDES OF NITROGEN. P. Harteck and S. Dondes (to U. S. Atomic Energy Commission). U. S. Patent 2,898,277. Aug. 4, 1959.

A method is described for fixing nitrogen from air by compressing the air, irradiating the compressed air in a nuclear reactor, cooling to remove NO_2, compressing the cooled gas, further cooling to remove N_2O and recirculating the cooled compressed air to the reactor.

2401
METHOD OF PREPARING METAL FLUORIDES. J. J. Katz and I. Sheft (to U. S. Atomic Energy Commission). U. S. Patent 2,899,269. Aug. 11, 1959.

A method is presented for preparing the halides of elements which are relatively non-reactive with halogenating agents. The method involves reacting a mixture of an oxygen containing salt of a difficulty halogenated metal with an oxygen containing salt of an easily halogenated metal with a halogenating agent. Accordingly plutonium tetrafluoride is produced by reacting a mixture of plutonium dioxide and uranium octaoxide with bromine trifluoride. The reaction proceeds smoothly at moderate temperatures and the resulting plutonium trifluoride may be readily separated from many impurities which form volatile fluorides by volatilizing these volatile fluorides from the reaction chamber.

2402
PRODUCTION OF THORIUM FLUORIDE. W. H. Zachariasen (to U. S. Atomic Energy Commission). U. S. Patent 2,899,270. Aug. 11, 1959.

A process is presented for producing anhydrous thorium fluoride comprising the step of contacting a saturated aqueous solution of thorium nitrate with an aqueous solution of hydrofluoric acid having a concentration of about 45 to 50% by weight at a temperature above 70°C whereby anhydrous thorium fluoride precipitates.

2403
SEPARATION OF TIN FROM ALLOYS. W. T. Kattner (to U. S. Atomic Energy Commission). U. S. Patent 2,899,295. Aug. 11, 1959.

A process is described for recovering tin from bronze comprising melting the bronze; slowly cooling the melted metal to from 280 to 240°C whereby eta-phase bronze crystallizes; separating the eta-bronze crystals from the liquid metal by mechanical means; melting the separated crystals; slowly cooling the melted eta-crystals to a temperature from 520 to 420°C whereby crystals of epsilon-bronze precipitate; removing said epsilon-crystals from the remaining molten metal; and reintroducing the remaining molten metal into the process for eta-crystallization.

Analytical Procedures

2404 AECU-4471
Nuclear-Chicago Corp., Chicago.
EXPLORATION OF RADIOMETRIC METHODS. Report No. 3. William J. Driscoll. Nov. 13, 1959. 8p. Contract AT(11-1)-695. OTS.

An investigation of the possibility of analyzing mixtures of halide ligands by radiometric methods using radiosilver as the precipitating agent was undertaken. The technique used is to add an excess of $AgNO_3$ containing Ag^{110} to a halide mixture, centrifuging and assaying the supernate. (W.L.H.)

2405 AERE-AM-54
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Chatham Outstation, Kent, England.
THE DETERMINATION OF NICKEL IN BERYLLIUM COMPOUNDS (FLUORIDE, HYDROXIDE AND AMMONIUM FLUORBERYLLATE). J. Walkden. Aug. 1959. 6p. BIS.

Solutions of the samples are fumed with sulfuric acid to remove fluoride, and the residues are dissolved in water. After making alkaline with ammonia in the presence of citrate, the nickel dimethylglyoxime is extracted into chloroform and the nickel back extracted into hydrochloric acid. The oxidized nickel dimethylglyoxime complex is formed and the nickel is determined absorptiometrically. The method is suitable for the determination of 2 to 100 ppm of nickel in beryllium fluoride and 1 to 50 ppm in beryllium hydroxide and ammonium fluorberyllate. Except at lower levels the error should not exceed ±5%. (auth)

2406 AERE-M-428
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MONITORING OF D_2O FOR TRITIUM CONTAMINATION. R. M. Fry. July 1959. 11p. BIS.

A simple and rapid method for monitoring drums of D_2O for tritium contamination is described. DTO vapor above the heavy water surface is transferred to an ion chamber, the resulting ion current being a measure of the specific activity of the D_2O. The apparatus described can detect concentrations of 0.1 μc/g. (auth)

2407 DP-392
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
DETERMINATION OF DEUTERIUM, OXYGEN, AND NITROGEN IN HELIUM BY GAS CHROMATOGRAPHY. David L. West. Sept. 1959. 9p. Contract AT(07-2)-1. OTS.

The determination of deuterium, oxygen, and nitrogen in helium by gas chromatography was demonstrated. The precision and the accuracy of the gas chromatographic method were comparable to those of a mass spectrometric method. The low capital investment, ease of operation and maintenance by nontechnical personnel, and adaptability to automatic monitoring are the major advantages of this chromatographic method. (auth)

2408 IG-R-97(O/S)
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
ANALYTICAL METHOD FOR THE VOLUMETRIC DETERMINATION OF VANADIUM IN URANIUM–VANADIUM ALLOYS. July 16, 1959. 5p. BIS.

Vanadium is oxidized to the pentavalent state by the

addition of potassium permanganate to a sulfuric acid solution of the alloy. Vanadium is then determined by the addition of excess ferrous ammonium sulfate and back titration using potassium dichromate. The method is applicable to alloys containing more than 1% w/w of vanadium. (auth)

2409 IGR-198(O/CA)

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF COPPER IN MERCURY. July 30, 1959. 8p. BIS.

The impurities present in the mercury are oxidized with compressed air in an elevated temperature and obtained as an acid solution by passing the mercury in the form of a very fine spray through a dilute solution of nitric acid. The copper in the acid solution of the impurities is determined absorptiometrically as the diethyl dithiocarbamate complex. The method is applicable to the determination of copper in mercury containing from 2 to 150 μg of copper per 100 g of mercury. Concentrations outside this range can be determined by suitable adjustment of the sample aliquot. (auth)

2410 NAA-SR-Memo-3793

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

METHOD FOR THE ANALYSIS OF DIPHENYL–TERPHENYL ORGANIC COOLANT MIXTURES BY GAS CHROMATOGRAPHY. R. A. Baxter. Apr. 27, 1959. 8p. OTS.

Polyphenyl mixtures in the diphenyl-terphenyl range are being used as moderator-coolants. A gas chromatographic method was developed for the quantitative determination of diphenyl, ortho-, meta-, and para-terphenyl in various organic coolant mixtures. The technique involves relating the component peak heights to the peak height of an added internal standard after determination of the appropriate calibration factors. The method was successfully used in the analysis of both unirradiated and irradiated coolant containing up to 4% high boilers. The accuracy and precision of the method was checked by analyzing four known synthetic mixtures. The average relative error obtained from fifty-four determinations was ±1.7% with a range of +4.6 to −6.4%. (W.L.H.)

2411 PGR-24(S)

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF COPPER IN ZIRCONIUM METAL, ZIRCALOY 2 AND 4% URANIUM–ZIRCONIUM ALLOYS. 1959. 7p. BIS.

Copper is determined absorptiometrically as the diethyl dithiocarbamate complex after precipitation of zirconium as hydroxide and extraction of nickel using dimethylglyoxime. The method is suitable for samples having a copper content of 5 to 60 μg. (auth)

2412

MEASUREMENT OF BULK DENSITY AND ITS INFLUENCE ON MOISTURE DETERMINATION WITH NEUTRONS. W. Kühn (Instit., Wildbad, Wurttemberg, Ger.). Atompraxis 5, 335-8(1959). (In German)

Since moisture measurement by neutrons in weight percentages within a substance is dependent upon density, it is shown how the influence of density on moisture measurement can be eliminated by using a parallel γ-density measurement, independent of moisture content. (auth)

2413

COMPLEXOMETRIC TITRATIONS (CHELATOMETRY). XLIII. MASKING OF DIVALENT METALS WITH o-PHENANTHROLINE. SELECTIVE DETERMINATION OF LEAD AND ALUMINUM. R. Přibil and F. Vydra (Tschechoslowakische Akademie der Wissenschaften, Prague). Collection Czechoslov. Chem. Communs. 24, 3103-8(1959) Sept. (In German)

In acid medium, o-phenanthroline forms complexes with divalent cations of Cd, Zn, Co, Ni, and Mn stronger than those with EDTA. But o-phenanthroline almost does not react with cations of some trivalent elements, the rare earths, and the Pb^{2+} ion. This behavior was used for a highly selective complexometric determination of Pb and an indirect determination of Al in the presence of the above elements. (tr-auth)

2414

USE OF THORIUM NITRATE IN TITRATION OF FLUORINE AFTER ITS SEPARATION FROM URANIUM BY ION EXCHANGE RESINS. F. Vogliotti (Laboratorio Ricerche, Porto Marghera, Italy). Energia nucleare (Milan) 6, 661-4 (1959) Oct.

The specific determination of fluorine in $NaUF_5$ and UF_4 with cationic resins, involves the following procedure: The sample under test is decomposed with sodium hydroxide and hydrogen peroxide. The solution is passed through a column filled with a cationic ion exchange resin type IR 120 and the obtained anionic solution is titrated with standard 0.05 N thorium nitrate. The procedure for the preparation of standard thorium nitrate and the method of conversion of resin into a hydrogen form is also given. A general description of the method of analysis, discussion on the result obtained, and main advantageous features of the new analytical method are presented. (auth)

2415

THE DETERMINATION OF C IN IRON BY THE RADIOACTIVATION METHOD. L. Simon. Hutnické listy 13, 708-11 (1958). (Translated from Referat. Zhur. Khim. No. 8, 1959, Abstract No. 27079)

A method for the determination of C in iron based on the irradiation of the samples to be analyzed with protons or deuterons according to the reactions $C^{12}(p,\gamma)N^{13}$ or $C^{12}(d, n)N^{13}$ is presented. The activity is measured with a Geiger-Mueller counter or by the autoradiographic method. Results from the analysis of different steels are given, particularly steels containing Co, Cr, Cu, and Ni.

2416

A COLORIMETRIC DETERMINATION OF MICRO AMOUNTS OF BORON, AND ITS APPLICATIONS FOR THE ANALYSIS OF BERYLLIUM METALS. K. Kida, M. Abe, S. Nishigaki, and K. Kobayashi (Nippon Gaishi Kaisha, Ltd. [Japan]). J. Atomic Energy Soc. Japan 1, 128-33(1959). (In Japanese)

A procedure for the determination of micro amounts of boron is described. A sample containing 0.05 to ~2μg of boron is dissolved in sulfuric acid to which is added 25 ml of methanol. The mixture is distilled and the distillate is caught in $Ca(OH)_2$ suspension. After evaporation to dryness, HCl and oxalic acid–curcumin are added and the mixture kept at 58 ± 0.5°C. The boron complex is extracted from the residue with ethanol. The boron complex color was measured at 540 mμ. The method is applicable to the determination of 0.05 to ~0.1 ppm of boron within 5% error. The method was applied to boron determination in metal beryllium and beryllium hydroxide. (C.J.G.)

2417

ULTRA SMALL CONCENTRATIONS OF RADIOELEMENTS IN SOLUTIONS. V. I. Grebenshchikov. Khim. Nauka i Prom. 4, 448-56(1959). (In Russian)

Adsorption, desorption, extraction dialyses, ultrafiltration, centrifugation electrophoresis, radiographic, and other methods for determining ultra-small quantities of radio elements in ionic, molecular, and pseudo-colloidal states are surveyed. 84 references. (R.V.J.)

2418

CHEMISTRY OF NEW ELEMENTS OF TECHNETIUM, PROMETHIUM, ASTATINE AND FRANCIUM. Yu. B. Gerlit, F. I. Pavlotskaya, and S. S. Rodin. Khim. Nauka i Prom. 4, 465-72(1959). (In Russian)

Chemical properties and application of At, Fr, Pn, and Te were studied and methods for their separation and determination are discussed. 114 references. (R.V.J.)

2419

MEASUREMENT OF LOW β AND α ACTIVITIES IN THE WATER. A. Dannecker, H. Kiefer, and R. Maushart (Kernreaktor-Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.). Nukleonik 1, 319-24(1959) Oct. (In German)

A chemical method based on coprecipitation and adsorption phenomena is described for the determination of small activities in water. With this method large masses of water can be examined in a short time and specific activities of $<10^{-8}$ $\mu c/cm^3$ can be measured with good accuracy by the combined use of a large surface flow-through counter of a new design. The standardization of the method was given for fall-out, uranium fission products, and 13 different single isotopes. The efficiency of this method was discussed in comparison with ion exchange and evaporation methods. (tr-auth)

2420

SPECTRAL DETERMINATION OF MICROQUANTITIES OF Ti, Nb AND Ta IN NATURAL MATERIALS. T. M. Moroshkina and V. K. Prokof'ev. Vestnik Leningrad. Univ., Ser. Fiz. i Khim. No. 2, 143-8(1959).

The separation and determination of the elements mentioned in the title by chemical methods are very difficult, especially when they are present in microquantities. It is possible to separate spectral lines of the elements Ti, Nb, and Ta which are not superposed by the spectra of the accompanying elements, and which do not overlap one another. The analytical lines which can be used include: Ti-4305.92 A, Nb-2927.81 A, Ta-2933.55 A, Nb-2950.88 A, Ta-2951.9 A. The lines of U (λ = 4297.11) or Cr (λ = 4297.73 A) were used as comparative lines for Ti. The Nb- and Ta-lines served as intrinsic standards. A description of the apparatus and procedure is included. (TCO)

2421

CHROMATOGRAPHIC DETERMINATION OF Mo IN PRESENCE OF OTHER ELEMENTS BY PLATINUM AND MERCURY ELECTRODES. A. I. Busev and Li Gyn. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 1, 187-95(1959). (In Russian)

Titration of hexavalent molybdenum with divalent chromium salt solution was studied. It is shown that tungsten and graphite electrodes are preferable to platinum. Conditions for chromometric titration of hexavalent molybdenum in solutions containing trivalent iron and tetravalent titanium were also studied using platinum and mercury electrodes. (R.V.J.)

2422

COLORIMETRIC DETERMINATION OF THORIUM USING CERTAIN AZO COMPOUNDS. E. S. Przheval'skii, A. P. Golovina, and A. F. Kuteĭnikova. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 99-104 (1959). (In Russian)

A colorimetric method of thorium determination by sulfophenazoxine, arsenazo, and thoron was developed. The colorimetric determination of Th by thoron was achieved in the presence of U^{6+}, Ce^{3+}, and La. It is also shown that thorium determination by arsenazo is possible in the presence of uranium and rare earths. The thorium composition with arsenazo was found to be in a ratio of 1:1. (R.V.J.)

2423

DETERMINATION OF URANIUM USING CHROMIUM(II) COMPOUNDS. E. R. Nikolaeva. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 105-9 (1959). (In Russian)

The rates of Cr^{2+} oxidation by oxygen in salt and sulfuric acid solutions and in the presence of acetate were determined. The method based on preliminary recovery of U^{6+} by Cr^{2+} salts with subsequent oxidimetric determination was checked and verified, and the effects of a series of factors on the potentiometric uranium titration by chromium were studied. The chrometric method of U^{6+} determination in the presence of vanadium concentration of U:V = 1:1 was also checked and verified. (R.V.J.)

2424

ANALYTICAL PROPERTIES OF 2-MERCAPTOBENZIMIDAZOLE (MICRODETERMINATION OF Pt, Pd, Rh, AND Ir BY MERCAPTOBENZIMIDAZOLE). L. N. Lomakina and N. I. Tarasevich. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 149-55(1959). (In Russian)

Properties of Pt^{+}, Pd^{2+}, Rh^{3+}, and Ir^{4+} complexes with 2-mercaptobenzimidazole are analyzed and their compositions are determined at various hydrogen ion concentrations. An attempt is made to determine the metals microquantitatively using the 2-mercaptobenzimidazole reagent. (R.V.J.)

2425

APPLICATIONS OF PERIODATE IN QUANTITATIVE DETERMINATION OF CERTAIN RARE ELEMENTS. I. P. Alimarin, Ts'en Yun-o, and I. V. Puzdrenkova. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 201-6(1959). (In Russian)

Applications of potassium periodate for Ce determination in the presence of rare earths and in amperometric determination of Zr and Th were studied. A new potentiometric method is developed for determining Tl^{+} by potassium periodate. Applications of potassium diperiodate cuprates for potentiometric determination of Th^{+} and Sb^{3+} in alkali media are checked and verified. It is also shown that in alkali media rare-earth elements form complex compounds with potassium periodates. (R.V.J.)

2426

SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM WITH 2-(4-SULFONAPHTHYLAZO)-1, 8-DIHYDROXY-2'-NITROSONAPHTHALENE-3,6-DISULFONIC ACID. Sachindra Kumar Datta (Darjeeling Government Coll., Calcutta and Bose Research Inst., Calcutta). Z. anorg. u. allgem. Chem. 301, 215-19(1959) Sept.

Zirconium forms a soluble reddish brown complex with 2-(4-sulfonaphthylazo)-1,8-dihydroxy-2'-nitrosonaphthalene-3,6-disulfonic acid, allowing the spectrophotometric determination of zirconium. Several ions interfere with the determination.

2427

URANIUM DETERMINATION IN STONE METEORITES BY MEANS OF NEUTRON ACTIVATION OF THE XENON ISOTOPES 133 AND 135. H. König and H. Wänke (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 866-9(1959) Oct. (In German)

The uranium content of eight stone meteorites, five chondrites, and three achondrites were determined by a neutron activation method for very small uranium concentrations. The method is based on the measurement of Xe^{133} and Xe^{135} produced by the fission of U^{235}. It is shown that with one exception all the chondrites investigated have an almost constant uranium content of 1×10^{-8} g/g meteorite. The uranium content of the achondrites has a wide variation. The thorium/uranium ratio in the stone meteorites has a mean value of 3.46. (tr-auth)

2428

LA MÉTHODE D'ANALYSE PAR ACTIVATION EN UTILISANT LES NEUTRONS D'UNE SOURCE Ra–Be. (Method of Activation Analysis Using Neutrons from a Ra–Be Source). Monograph No. 2. G. Guében and J. Govaerts. Brussels, Institut Interuniversitaire des Sciences Nucléaires, [1957.] 131p.

The techniques and applicability of neutron activation analysis with a Ra-Be source are discussed, and experimental results are given. Examples of practical application given are the determinations of Cu, V, Mn, Dy, Au, As, I, Ag, Cr, and W. (T.R.H.)

2429

SIMPLE DEVICE FOR THE TRACKING AND MEASUREMENT OF RADIOACTIVE GASES CONTAINED IN AIR. (to Auergesellschaft Aktiengesellschaft). German Patent DAS 1037 030. Aug. 21, 1958. Atompraxis 5, 330(1959). (In German)

A simple testing capillary tube is described through which the air to be tested is drawn by a hand-operated gas detection pump. The capillary tube contains a fluorescent layer which is sensitive to alpha radiation. The crystals of the luminescent material are coated with activated silica gel or mixed with its crystals. The silica gel absorbs the air being pulled through the tube. If the air is contaminated, a glow which can be detected and measured quantitatively with photocells or multipliers, appears in the luminescent layer. (J.S.R.)

Radiation Chemistry

2430 WCLT-TM-58-152

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EFFECTS OF GAMMA RADIATION ON AN ETHYLENE GLYCOL–WATER SYSTEM. Dennis R. Johnson. Dec. 30, 1958. 5p. Project 7360.

A study was made of the effects of radiation on an ethylene glycol-water system as a low-temperature coolant. Of primary concern was the total gas evolution as well as the viscosity change in a 65 to 35% glycol-water mixture. (auth)

2431

NON-RADIATIVE TRANSITIONS IN β-NAPHTHYLAMINE. Z. Simon. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 317-28(1959). (In Rumanian)

Data are analyzed from experiments on fluorescence and phosporescence of aromatic hydrocarbons and their derivatives (without non-participating electron doublets) in gaseous state and in solution. Using these data, an hypothesis was evolved which explains the fluorescence as being due to a non-radiative transition between the excited singlet and fundamental singlet states. This transition requires an energy of activation whereas the appearance of the fluorescence is conditioned by the non-radiative excited singlet-triplet transitions, which are practically independent of the temperature. The velocity constants for the non-radiative transitions were calculated by virtue of certain theoretical hypotheses previously pointed out, on the β-napthylamine model. The temperature dependence and order of size of the calculated velocity constants are verified by experiment. (tr-auth)

2432

THE VARIATIONAL PRINCIPLE IN THE OPTICAL MODEL OF NUCLEAR REACTIONS WITH NEUTRONS. I. Brandus. Acad. rép. populaire Roumaine, Rev. phys. 4, 255-62(1959). (In French)

The variational principle of Schwinger was used to avoid certain inconveniences in theoretical calculations regarding the optical model for neutron reactions. (T.R.H.)

2433

ROENTGENOGRAPHIC STUDY OF THE EFFECTS OF HEAT ON THE STRUCTURAL STATE OF POLYETHYLENE IRRADIATED BY GAMMA RAYS IN A VACUUM. Yves de Zarauz (Centre National de la Recherche Scientifique, Paris). Compt. rend. 249, 1348-50(1959) Oct. 12. (In French)

The structure of a low-pressure polyethylene irradiated under vacuum by γ rays is not changed up to 150 Mr. Heating causes an important diminution of crystallinity to appear due to destruction of the gel in the crystalline lattice of the polymer. (tr-auth)

2434

RADIOCHEMICAL FORMATION OF PHENOL SENSITIZED BY SEMI-CONDUCTORS. Jacques Preve and Roger Montarnal (Centre d'Études nucléaires, Grenoble, France). Compt. rend. 249, 1667-9(1959) Oct. 28. (In French)

It is possible to sensitize, by semi-conductors, the radiochemical and photochemical formation of phenol in aqueous solutions of NaOH saturated with benzene. The mechanism of this sensitization should be analogous to that causing the formation of H_2O_2. A G_s, characteristic for the semi-conductor, can be calculated from the increase in yield. The semi-conductors tested included ThO_2, ZnO, ZnS, CuO, CaO, Co_2O_3, Al_2O_3, MgO, and TiO_2. No sensitizing effect was observed for CaO, MgO, and Al_2O_3. (J.S.R.)

2435

HOT-ATOM CHEMISTRY OF OXYACIDS OF HALOGENS. I. BROMATE. N. Saitō, I. Tomita, and M. Furukawa (Univ. of Tokyo). J. Atomic Energy Soc. Japan 1, 196-202(1959). (In Japanese)

The behavior of recoil bromine atoms arising from the (n,γ) reaction on bromate samples in various physical states was studied. The samples irradiated with neutrons were bromate crystals, aqueous bromate solutions, and anion exchange resins loaded with bromate ions. A large fraction of radioactive bromine atoms appeared in a chemical form of bromide which may be separable from bromate by ion exchange or solvent extraction, whereas the remaining active atoms were found in bromate form. The degree of retention of active atoms as bromate was dependent strongly upon the physical state of the irradiated sample, decreasing in the following order; solid, solution, and resin. The retention values in the solid, solution, and resin sam-

ples were about 20, 5, and 1% respectively. Separation of bromate and active bromine in the irradiated resin samples was performed by successive treatment of the resin samples with 0.5M KNO_3 and then 2M KNO_3. The elution with 2M KNO_3 brought about an effluent containing active bromine atoms with an enrichment factor of several hundred. Some fraction of active bromine was retained in the resin phase even after the elution with KNO_3 was completed. Brief discussion is given regarding the mechanism of the retention of active atoms in solid, solution, and resin phases. (auth)

2436

ROLLING OF URANIUM SHEET AND ITS PROPERTIES. STUDIES ON URANIUM FUEL ELEMENT, (2). K. Taketani, Y. Sasaki, and M. Kurihara (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 319-29(1959). (In Japanese)

The rolling of uranium metal and some properties of the rolled specimens are reported. Bomb reduced uranium, melted in a vacuum high-frequency furnace, was rolled at room temperature, 300 and 600°C. Microstructures and hardness of the rolled specimens are shown. The thermal expansion coefficients of two specimens, cut perpendicular and parallel to the rolling direction, were measured and compared. It was found that uranium rolled at 600°C has the minimum anisotropic expansion coefficient and that rolled at room temperature has the maximum. X-ray diffraction patterns on the rolling plane were taken on a sample which was heat treated successively for 5 min at 20°C intervals from 670 to 760°C. The specimen in which (020) is not observed but (002) is predominant changes its crystal orientation structure, increasing (020) and decreasing (002). At higher temperatures more grain growth is obtained after the heat treatment. (auth)

2437

EFFECTS OF γ-RADIATION. PART I. POLYMER FORMATION FROM SUGARS, HYDROXY-ACIDS, AND AMINO-ACIDS. S. A. Barker, P. M. Grant, M. Stacey, and R. B. Ward (The University, Birmingham, Eng.). J. Chem. Soc., 2648-54(1959) Sept.-Oct.

Acidic polymers were formed by γ-irradiation of aqueous solutions of maltose, glucose, 1:4-gluconolactone, lactic acid, glycollic acid, and amino-acid solutions in vacuo. The isolation and initial structural investigations of some of these polymers are described. (auth)

2438

EFFECTS OF γ-RADIATION. II. CHARACTERISATION OF THE PRODUCTS FROM GLYCOLLIC ACID. P. M. Grant and R. B. Ward (The University, Birmingham, Eng.). J. Chem. Soc., 2654-8(1959) Sept.-Oct.

The non-volatile products formed by γ-irradiation of glycollic acid solutions in vacuo were isolated and identified as glyoxylic, oxalic, and tartaric acid. They are explained by formation and reactions of the carboxyhydroxymethly radical, $\cdot CH(OH) \cdot CO_2H$. The effect of oxygen on the reactions of the radical is discussed. Preliminary studies of the effect of γ-radiation on the products were made. (auth)

2439

EFFECTS OF γ-RADIATION. III. QUANTITATIVE STUDIES OF THE PRODUCTS FROM GLYCOLLIC ACID. P. M. Grant and R. B. Ward (The University, Birmingham, Eng.). J. Chem. Soc., 2659-65(1959) Sept.-Oct.

The decomposition of glycollic acid solutions induced by γ-radiation in vacuo and in the presence of oxygen was followed quantitatively. The concentrations of glycollic, glyoxylic, tartaric, oxalic, and formic acid, formaldehyde, and carbon dioxide were measured directly, and by new colorimetric methods in the cases of glycollic and glyoxylic acid. A mass balance for carbon was obtained, and degradation pathways are advanced to explain the results. (auth)

2440

EFFECTS OF γ-RADIATION. IV. THE DEGRADATION OF d-GLUCOSE IN AQUEOUS SOLUTION BY γ-IRRADIATION IN VACUO. P. M. Grant and R. B. Ward (The University, Birmingham, Eng.). J. Chem. Soc., 2871-6(1959) Sept.-Oct.

The effect of Co^{60} γ-radiation on aqueous solutions of glucose and maltose in vacuo was studied. Gluconic acid and 2-oxo-D-arabino-aldohexose were isolated as products. The latter was determined by a method utilizing its ready reaction with o-phenylenediamine. Evidence for other products is presented and a degradation mechanism discussed. (auth)

2441

FLUORESCENCE AND PHOTOCHEMICAL ACTION IN URANYL NITRATE SOLUTION. H. D. Bist (D.S.B. Government Coll., Naini Tal, India). J. Sci. Ind. Research. (India) 18B, 387-8(1959) Sept.

Irradiation of uranyl nitrate solutions containing NaOh and dissolved oxygen was studied. The fluorescence intensity showed rapid quenching upon initial irradiation, a minimum intensity stage, gradual restoration of intensity, and a photostationary state after which no noticeable changes in intensity took place. A deoxygenated solution showed a prolonged quenching effect with very gradual intensity restoration. If irradiation is stopped for some time the intensity is restored. (C.J.G.)

2442

NUCLEAR RADIATION EFFECTS ON GASEOUS REACTIONS. S. Ya. Pshezhetskiĭ. Khim. Nauka i Prom. 4, 509-15(1959). (In Russian)

Radio chemical reactions (primary and secondary elementary processes and stationary states under radiation) and the character of radiation reaction products and their ratios are analyzed. (R.V.J.)

2443

EFFECTS OF IONIZING RADIATION ON THE AQUEOUS SOLUTIONS OF INORGANIC COMPOUNDS. P. I. Dolin. Khim. Nauk i Prom. 4, 516-21(1959). (In Russian)

The mechanism of radiochemical reactions is discussed and product yields of aqueous radiolysis in neutral and acid solutions measured for β and γ radiation are analyzed. (R.V.J.)

2444

THE ELECTRON SPIN RESONANCE SPECTRUM OF A γ-IRRADIATED SINGLE CRYSTAL OF GLYCINE. D. K. Ghosh and D. H. Whiffen (Univ. of Birmingham, Eng.). Mol. Phys. 2, 285-300(1959) July.

It is shown that γ rays act on glycine to give the free radical $NH_3^+ — CH — CO_2^-$ which remains trapped in the solid. Electron spin resonance spectra from an irradiated single glycine crystal show marked anisotropy and it is deduced that the radicals are precisely oriented in the crystal lattice. The symmetry shown by the spectra is consistent with that of the crystal lattice. Despite overlapping of lines, the spectra due to the $NH_3^+ — CH — CO_2^-$ radical have been interpreted in terms of electron nucleus coupling tensors for the N, the $H_{(C)}$, and the three $H_{(N)}$ nuclei, the latter being equivalent by virtue of a rotation or

tunnelling of the $-NH_3^+$ grouping. A qualitative interpretation of these tensors in terms of the electronic structure of the radical is given. This is consistent with the negative spin density on the $H_{(C)}$ atoms and a positive spin density on the $H_{(N)}$ atoms, as predicted by theoretical treatments. The radicals appear to be oriented in the lattice in approximately the same way as their parent molecules. (auth)

2445

EFFECT OF GAMMA-RADIATION ON THE SYNTHESIS OF METHANOL OVER ZINC OXIDE. T. I. Barry and R. Roberts (Wantage Radiation Lab., Eng.). Nature 184, Suppl. No. 14, 1061-2(1959) Oct. 3.

No effect of gamma radiation was observed in the synthesis of methanol over ZnO_2 above 250 or below 175°C. Around 201 to 223°C the amount of methanol formed increased under irradiation. Irradiation of the catalyst did not greatly influence the normal reaction mechanism. (C.J.G.)

2446

DIMENSIONAL CHANGES IN SINGLE CRYSTALS OF SYNTHETIC SAPPHIRE AFTER IRRADIATION. D. G. Martin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. and Chem. Solids 10, 64-5(1959) Apr.

Dimensional changes along the principal axes of single crystals of synthetic sapphire were measured after irradiation at 30°C and subsequent annealing. (J.E.D.)

Radiochemistry

2447

A SIMULTANEOUS PRODUCTION OF SILICON-31 AND PHOSPHORUS-32. N. Ikeda and H. Ebihara (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 234-9(1959). (In Japanese)

Tributyl phosphate was bombarded with neutrons from the cyclotron with a neutron flux of $10^7 n/cm^2$ sec. The radioactive Si^{31} and P^{32} formed were extracted from tributyl phosphate with the various kinds of reagents. The percentage yield of separated Si^{31} activity showed the maximum value 87.5% when a potassium hydroxide solution of pH 12.5 was used, while the percentage yield of P^{32} showed a maximum value of 54.3% under the same conditions. Both anion and cation exchange resins were tried for the separation of Si^{31} and P^{32} from each other. The cation exchange resin Diaion SK-1 (ferric form) gave the most preferable results. Si^{31} and P^{32} separated by the procedure mentioned above were almost in a carrier-free form. The radiochemical purity of Si^{31} was 99.9% and that of P^{32} was nearly 100.0% (auth)

2448

ISOTOPIC EXCHANGE. A. I. Brodskiĭ. Khim. Nauka i Prom. 4, 423-34(1959). (In Russian)

Data are presented on the multiple applications of isotopic exchange in solving various chemical problems. 92 references. (R.V.J.)

2449

ON THE STABILIZATION PROCESSES OF RADIOACTIVE ISOTOPES PRODUCED IN NUCLEAR TRANSFORMATIONS. A. N. Nesmeyanov. Khim. Nauka i Prom. 4, 435-41(1959). (In Russian)

Various methods and transformations which may be used in the preparation of labeled compounds are reviewed. The end products from (n,γ) reactions in organic halides, (n,μ) reactions in CS_2, and (n,γ) reactions in $AsCl_3$ and $SbCl_3$ are tabulated. (D.E.B.)

2450

APPLICATION OF ISOTOPES IN STUDIES OF CHEMICAL PROCESS MECHANISM. S. Z. Roginskiĭ. Khim. Nauka i Prom. 4, 479-86(1959). (In Russian)

Certain kinetic problems of homogeneous and heterogeneous reactions are analyzed using isotopic effects as a means of the investigation. 59 references. (R.V.J.)

2451

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 20. ISOTOPES IN RESEARCH. Geneva, United Nations, 1958. 272p. $10.00.

Recent developments in the production and use of isotopes are presented. The trend of future developments in various fields of research is discussed by various papers. The manufacture of isotopes in reactors and linear accelerators, the enrichment of specific activity by chemical means, and the synthesis of labeled compounds are discussed. Other papers describe diffusion studies, exchange reactions, stable isotopes and radiochemistry. (W.L.H.)

Raw Materials and Feed Materials

2452 MCW-1438

Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.

PILOT PLANT DEVELOPMENT OF A SULFURIC-ACID SOLVENT-TREATMENT PROCESS. J. T. Krieg, N. G. Holloway, and N. Simecek. Nov. 30, 1959. 19p. Contract W-14-108-eng-8. OTS.

A sulfuric-acid solvent-treatment process was developed in the pilot plant for the removal of residual uranium from stripped TBP–hexane prior to carbonate treatment. Three theoretical stages of countercurrent washing with 10% H_2SO_4 were required to reduce the uranium concentration to less than 0.01 g/l. This result can be accomplished with 7 pumper-decanter units or by 3 electrostatic mixer-settlers. (auth)

Separation Processes

2453 BMI-1375

Battelle Memorial Inst., Columbus, Ohio.

CONSTRUCTION MATERIALS FOR VARIOUS HEAD-END PROCESSES FOR THE AQUEOUS REPROCESSING OF SPENT FUEL ELEMENTS. Charles L. Peterson, Paul D. Miller, James D. Jackson, and Frederick W. Fink. Aug. 28, 1959. 121p. For Oak Ridge National Lab. Contract [W-7405-eng-26, Subcontract No. 988]. OTS.

Materials of construction were evaluated for use in critical areas of head-end processes for the aqueous reprocessing of spent nuclear fuel elements. The Sulfex-Thorex, Darex-Thorex, Darex, Zirflex, and Zircex processes were considered. The effect of varying heat treatments on the resistance of the materials was also evaluated. Dissolution of unirradiated fuel pins was carried out in vessels of promising materials. The corrosion rate of Ni-o-nel was about 5 mils per month during actual fuel-pin dissolution by the Sulfex-Thorex process. Stabilization and heat treatment are necessary to prevent intergranular attack at welds. Carpenter 20 Cb is subject to stress-corrosion cracking by the Sulfex decladding solution and Illium R behaves similarly to Ni-o-nel in Thorex

solutions. Titanium shows promise as a construction material for a Darex-Thorex dissolver. However, several questions remain concerning a vapor-phase attack observed around certain weldments. Carpenter 20 Cb, Ni-o-nel, and Types 309 and 309S Cb stainless steel appeared worthy of further study for the Zirflex dissolver. Preliminary evaluations show that at least Ni-o-nel and Carpenter 20 Cb should be studied further as possible construction materials for a single vessel for Zirflex and Sulfex-Thorex processes. Illium R, Hastelloy C, and nickel were not attacked by hydrochlorination conditions of the Zircex process. Minor attack was found on Inconel and Type S-816 alloy. The corrosion of titanium was negligible in the Darex dissolver and feed-adjustment system. The use of Type 304 ELC stainless steel lines for transferring Darex dissolver solution is not recommended. No corrosion of Type 347 stainless steel was observed after exposure for 2 years to chloride-contaminated Purex extraction systems at room temperature. (auth)

2454 CF-59-9-2

Oak Ridge National Lab., Tenn.

URANIUM RECOVERY FROM SODIUM–ZIRCONIUM FLUORIDE SALT MIXTURES, VOLATILITY PILOT PLANT RUNS L-1 THROUGH L-9. C. L. Whitmarsh. Sept. 30, 1959. 75p. Contract [W-7405-eng-26]. OTS.

About 606 kg of sodium-zirconium fluoride salt mixture, similar to the ARE fuel but nonirradiated, was reprocessed in the Volatility Pilot Plant. Of the 72.28 kg of fully enriched uranium in the feed, 99.2% was recovered as uranium hexafluoride product, with 0.01% measured process losses. An additional 1% was reclaimed from sodium fluoride beds and clean-out of the system. The product was of sufficient purity to meet specifications for material designated for reduction to uranium metal. Plant operation was stopped for 20 days between Runs L-4 and L-5 to clean out the fluorinator. Precipitation of nickel fluoride had plugged all interior piping in that vessel. Development studies concerning decontamination and plutonium behavior were carried out. Fluoride salt from reactor loop experiments was added to Run L-7, with a resultant feed salt gross gamma activity of 5.1×10^6 cpm/g salt. Complete decontamination from fission products was achieved Results from three runs in which plutonium tetrafluoride was added to the feed salt indicated that greater than 99% of the plutonium would remain in the salt after fluorination. (auth)

2455 CNLM-1802-3

Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.

THE ION-EXCHANGE BEHAVIOR OF ALUMINUM, CHROMIUM, COBALT, MOLYBDENUM, NICKEL, NIOBIUM, TANTALUM, TITANIUM, TUNGSTEN, VANADIUM, AND ZIRCONIUM. A Bibliography. E. A. Cernak, comp. Oct. 9, 1959. 42p.

This bibliography contains 311 references on the separation, determination, and behavior of aluminum, chromium, cobalt, molybdenum, nickel, niobium, tantalum, titanium, tungsten, vanadium, and zirconium in ion exchange reactions. The references are arranged chronologically in twelve classifications. The sources used in the compilation are Abstracts of Classified Reports, 1948–Aug. 1959; Chemical Abstracts, 1945–Sept. 10, 1959, Nuclear Science Abstracts, 1948–Sept. 15, 1959; and the Card Catalog. (J.E.D.)

2456 DP-411

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

APPARATUS FOR SOLVENT EXTRACTION OF MILLILITER QUANTITIES OF HIGHLY RADIOACTIVE SOLUTIONS. Richard M. Wallace and Henry Pollock. Sept. 1959. 10p. Contract AT(07-2)-1. OTS.

A description is given of apparatus designed for studying the solvent extraction of small quantities of highly radioactive solutions. The equipment is inexpensive and is easily assembled in a laboratory hood. (auth)

2457 DP-421

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

REPROCESSING POWER REACTOR FUELS. Quarterly Progress Report No. 7 [for]April 1 to July 1, 1959. Leon H. Meyer and Edward S. Occhipinti, comps. Sept. 1959. 10p. Contract AT(07-2)-1. OTS.

Stainless steel cladding on power fuel elements can be dissolved electrolytically with equipment and reagents that may be compatible with the present SRP separations plant. Plutonium and uranium were extracted effectively from simulated dissolver solutions used for processing of Detroit-Edison core elements. A molar ratio of aluminum to total fluoride of 2.7:1 was found necessary to extract Pu(IV) with an extractant of tributyl phosphate in n-dodecane. For preceding period see DP-393. (auth)

2458 IDO-14471

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

IDAHO CHEMICAL PROCESSING PLANT TECHNICAL PROGRESS REPORT FOR JANUARY THROUGH MARCH 1959. C. E. Stevenson. Aug. 27, 1959. 70p. Contract AT(10-1)-205. OTS.

Procedures used in decontaminating the continuous dissolution-TBP extraction headend system for minor modifications are described. Reagents used included a proprietary system as well as nitric acid, caustic, and complexing materials. Modifications made included replacements of remote head pumps with air lifts, and installation of a titanium tube bundle for waste evaporation. Sources of radioactive particles observed in vented gases are discussed. A study of fuel storage basin water treatment indicated that growth of microorganisms was causing filter plugging. In studies of processing aluminum fuels under highly acid-deficient conditions, it was found that uranium-bearing residues remained after dissolution to higher pH levels or to less concentrated products. Practical operating conditions were defined. Stability studies of aluminum-zirconium solutions, as occur in the hydrofluoric acid process for zirconium dissolution, indicated that little further concentration above presently used levels was possible without potential precipitation, although within certain regions precipitation occurs so slowly that more concentrated solutions can be stored for weeks. A process providing for a 0.75M zirconium feed solution was accordingly devised. Limiting conditions for dissolving zirconium alloys containing 2 to 3% uranium by oxidation with nitric acid or peroxide were determined. In attempts to separate zirconium from hydrofluoric acid solutions by precipitation of barium fluozirconate, 10 to 20% of the uranium was carried on the precipitate. When zirconium was precipitated with ammonia, uranium was completely co-precipitated with a marked reduction in the F/Zr ratio. Zirconium was also precipitated from aluminum-complexed raffinate by destroying nitrate with formaldehyde. A modification of the ammonium fluoride process for zirconium dissolution, in which zirconium would be reprecipitated as barium fluozirconate with low uranium loss, was also developed. Studies of zirconium dissolution in nitric-hydrofluoric acid mixtures indicated that the consumption of hydrofluoric

acid decreased as the nitric acid concentration was increased. Zirconium was converted to the volatile tetrachloride, and separated from uranium, by reaction with fused lead chloride. Canned rotor pumps with special bearings and impellers welded to the shaft have operated on test continuously for nearly a year. Centrifugal pumps showed some erosion when circulating a thin alumina slurry. Automatic control of product removal from an evaporator through control of air to an air lift was successfully demonstrated. Silica gel used to adsorb ruthenium, as will be generated in the fluid bed conversion of aluminum nitrate wastes to alumina, adsorbed over 40 grams of ruthenium per cubic foot of gel in repeated adsorption-regeneration cycles. Operation of the NaK-heated pilot plant calciner on a series of tests to define variable effects was initiated. Rate of particle growth was followed by addition of a manganese salt. Fine particles were electrostatically precipitated from simulated calciner off-gas with high efficiency. The status of construction of the demonstrational calcining facility is described. In further studies of electrolytic removal of stainless steel constituents from nitrate wastes using a mercury pool cathode, the effects of concentration variables were defined. Polarographic studies indicated that the reduction of chromic ion is irreversible. When destroying nitrate present in aluminum process wastes, mercury may also be reduced and separated either as mercurous chloride or metallic mercury. Analytical methods were developed or modified for the determination of boron, molybdenum, and tin. (auth)

2459 IDO-14489

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CHARACTERIZATION OF SURFACTANTS IN ALUMINUM–URANIUM FUEL REPROCESSING SOLUTIONS. R. D. Cannon. Oct. 20, 1959. 21p. Contract AT(10-1)-205. OTS.

Surface active materials in aluminum nitrate-nitric acid fuel reprocessing solutions were characterized. Polymerized silica, zirconium-modified silica and soluble dibutyl phosphate species were found to contribute to stable emulsion formation. These surfactants were reduced in effectiveness by added acid. (auth)

2460 MCW-1436

Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.

REMOVAL OF CHLORIDE FROM NITRIC ACID BY OXIDATION WITH PERMANGANATE. G. P. Lang, S. W. Weidman, W. P. Armstrong, G. L. Martin, and W. G. Bradford. Nov. 23, 1959. 28p. Contract W-14-108-eng-8. OTS.

Nitric acid is commonly recovered from uranium refinery raffinates by distillation and subsequent rectification. The presence of chloride in these raffinates presents a serious corrosion problem during nitric acid recovery because of the considerable build-up of this ion during the rectification step and its corrosive effect on stainless steel process equipment. Laboratory investigation of this problem resulted in a method of control whereby chloride can be removed by oxidation to chlorine with potassium permanganate. Studies included the effect of temperature, hydrogen ion concentration, air sparge rate, stainless steel surface, and tri-n-butyl phosphate on the reaction of permanganate with chloride in nitric acid solutions. The use of $NaNO_2$ following treatment with permanganate was recommended to dissolve MnO_2 formed by side reactions and to reduce excess permanganate, eliminating the need for filtration of the treated acid. (auth)

2461 NAA-SR-2309

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

GAS-HANDLING SYSTEM FOR THE PROCESSING REFABRICATION EXPERIMENT. H. Bernard. Aug. 15, 1958. 79p. Contract AT-11-1-GEN-8. OTS.

In the process proposed by the Processing Refabrication Experiment (PRE) as outlined various gases, fumes, and particulates are evolved during the melting operation and are carried off in a helium gas stream. The contaminants are removed from the carrier gas by either electrostatic or impingement filters and liquid metal or solid adsorbers. This project was undertaken to review the literature of adsorption of inert off-gases on silica gel, and to design, construct, and operate adsorption test equipment to ascertain the design parameters for a PRE pilot plant. (auth)

2462 NAA-SR-3269

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TERMINAL STATUS REPORT FOR THE PROCESSING REFABRICATION EXPERIMENT. D. I. Sinizer, K. L. Mattern, and E. G. Kendall. Nov. 15, 1959. 210p. Contract AT(11-1)-GEN-8. OTS.

A review of progress in the PRE program is presented. It is pointed out that this program is a significant contribution to the concept of low-decontamination processing for irradiated nuclear fuels. In the mock-up program, equipment development progressed to the point where a facility for processing metallic uranium fuel may be designed which can be remotely operated and maintained. A study of equipment for processing UO_2 fuels was started and it is estimated that an additional year of research and development are required to design a facility for processing this material. (J.R.D.)

2463 NAA-SR-Memo-3954

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRELIMINARY INVESTIGATION OF THE Ag–Mg SYSTEM FOR RECOVERY OF URANIUM FROM Th–U ALLOY. L. A. Hanson. June 8, 1959. 16p. OTS.

A preliminary investigation was made on separating U from Th–U alloys using a liquid metal Ag–Mg system. A method for recovery of the Th is also proposed. (W.L.H.)

2464 ORNL-2785

Oak Ridge National Lab., Tenn.

SULFEX PROCESS: DEPASSIVATION OF STAINLESS STEEL. T. A. Gens. Nov. 20, 1959. 12p. Contract W-7405-eng-26. OTS.

The time required to break the passivation of films on 304 stainless steel produced by 1 hr treatment in refluxing 15.8 M HNO_3–0.025 M Cr(III) decreased as the sulfuric acid concentration increased and increased greatly when nitric acid was added to the sulfuric acid. The films resisted refluxing 6 M H_2SO_4 for 7 min, 6 M H_2SO_4–0.001 M HNO_3 for 2 hr, and 6 M H_2SO_4–0.01 M HNO_3 for several days. In refluxing 12 M H_2SO_4 the films dissolved in about 10 sec with up to 0.001 M HNO_3 in the solution, but 0.5 hr was required with 0.01 M HNO_3. The addition of 0.1 M HCOOH to refluxing sulfuric acid solution effectively destroyed as much as 0.01 M HNO_3. Films on stainless steel specimens in contact with platinum resisted refluxing 6 M H_2SO_4 for several hours. Films on bundles of 304 stainless steel tubes brazed together with Nicrobraze-50 dissolved instantly in refluxing 6 M H_2SO_4. (auth)

2465 ORNL-2820

Oak Ridge National Lab., Tenn.

SOLVENT EXTRACTION RECOVERY OF VANADIUM

(AND URANIUM) FROM ACID LIQUORS WITH DI(2-ETHYLHEXYL) PHOSPHORIC ACID. D. J. Crouse and K. B. Brown. Nov. 25, 1959. 81p. Contract W-7405-eng-26. OTS.

Bench-scale studies were made on use of di(2-ethylhexyl)-phosphoric acid in an organic diluent (Dapex process) for solvent extraction recovery of vanadium from acid leach liquors. Vanadium may be stripped from the solvent by either acidic or alkaline reagents, the former having been studied in considerably greater detail. A process for single-cycle recovery and separation of uranium and vanadium from sulfate leach liquors was shown to be attractive both from the standpoint of operation and chemical costs. Process schemes for recovery of vanadium from uranium-barren liquors are also described. On the basis of the encouraging laboratory results, pilot scale tests for specific applications are recommended. (auth)

2466 ORNL-2830

Oak Ridge National Lab., Tenn.

RECOVERY OF URANIUM AND PLUTONIUM FROM SULFURIC ACID DECLADDING SOLUTIONS. D. E. Horner and C. F. Coleman. Nov. 25, 1959. 46p. Contract W-7405-eng-26. OTS.

Uranium and plutonium were recovered by liquid-liquid extraction from simulated sulfuric acid stainless steel decladding solution with several extractants. Consecutive extraction of U(IV) and Pu(III) or (IV) by 0.1 to 0 3 M primary amine in hydrocarbon–alcohol diluent appeared promising, and chemical flowsheets were demonstrated in laboratory-scale continuous countercurrent extraction. Extraction of U(VI) with a dialkylphosphoric acid appeared promising when plutonium recovery is not needed. Recovery is also chemically feasible by extraction of U(VI) and Pu(IV) with an N-benzyl secondary alkyl amine or a trialkylphosphine oxide. The amine extracts are stripped with nitric acid, giving a sulfate-nitrate product solution. The organophosphorus extractants permit elimination of the sulfate but require sodium carbonate for stripping. (auth)

2467 WCAP-6033

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. SPECIFIC GRAVITY INSTRUMENTS FOR A NUCLEAR FUELS REPROCESSING PLANT. W. E. Foster and E. R. Rosal. Dec. 1, 1959. 40p. Contract AT(30-1)-2176, Task 1. OTS.

Specific gravity instrumentation suitable for a nuclear fuels reprocessing plant was evaluated for possible use in a Nuclear Materials Control System (NMCS). Two basic types of instruments were considered: Pneumatic "bubbler" instruments intended primarily for use in process tanks; and Pipe-line units for continuous monitoring of process streams. Pneumatic instrument systems using both a two and a four dip-tube assembly were built and installed in the feed and product tank respectively of the NMCS Test Loop. The two tube system was tested on various (aqueous) solutions of uranyl nitrate in nitric acid. Two sigma limits on the precision of the two tube system were conservatively estimated to be ±0.009 specific gravity units for a range of 1.0 to 1.6 specific gravity units. At prime accountability points of a chemical processing plant under stringent inventory control, two assemblies with four dip-tubes, dual sensing units, and appropriate tamper-resistant features are recommended. A pipe-line instrument for monitoring the specific gravity of process streams on a continuous basis ("Densitrol") was purchased and installed on the NMCS Test Loop. A calibration on uranyl nitrate-nitric acid (water) solutions yielded a prediction equation with two sigma limits of about ±0.0034 specific gravity units over a span of 0.18 specific gravity units. The instrument appears promising for further evaluation as a continuous monitor of process stream density, or as a supplement to an in-line analytical instrument. Appropriate tamper-resistant features are specified for use with the Densitrol when it is included in a Nuclear Materials Control System. (auth)

2468 WCAP-6034

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. LIQUID LEVEL INSTRUMENTS FOR A NUCLEAR FUELS REPROCESSING PLANT. E. R. Rosal. Dec. 1, 1959. 46p. Contract AT(30-1)-2176, Task 1. OTS.

Liquid level instrumentation for a nuclear fuels reprocessing plant was evaluated for possible application in a Nuclear Materials Control System (NMCS). Two basic types of instruments were considered: Pneumatic "bubbler" systems, intended primarily for use with radioactive solutions, and fielden (capacitance) probes, intended for use with decontaminated product solutions. A pneumatic instrument system using a two dip-tube assembly was built and installed in the product tank of the NMCS Test Loop. The system was tested with various aqueous solutions of uranyl nitrate in nitric acid. Methods for calibration of tank volumes and liquid level instruments are discussed. The precision of a two dip-tube system was found to be 0.6 percent of the full scale value (65 inches) and the results of the statistical analysis of the calibration data are presented at the 95 percent confidence level. A four dip-tube assembly with dual sensing elements and appropriate tamper-resistant features is recommended for NMCS use. The Fielden capacitance instrument has been extensively tested at the Savannah River Plant where it was found to be vulnerable to radiation damage. Therefore, it can be used only with decontaminated material. Shielded capacitance probes with appropriate tamper-resistant features are recommended for NMCS use. (auth)

2469

DISTRIBUTION OF NEPTUNIUM BETWEEN TBP AND SOME MINERAL ACIDS. Tomitaro Ishimori and Eiko Nakamura (Japan Atomic Energy Research Inst., Tokyo). Bull. Chem. Soc. Japan 32, 713-20(1959) July.

The extraction of Np with TBP was studied with emphasis on its oxidation states. The solvent systems studied were HNO_3–TBP, H_2SO_4–TBP, and $HClO_4$–TBP. The isolation of Np from irradiated uranyl nitrate was studied. (J.E.D.)

2470

ISOLATION OF ZIRCONIUM AND NIOBIUM FROM FISSION PRODUCTS BY SOLVENT EXTRACTION WITH DILUTE TBP. T. Ishimori, H. Umesawa, and K. Watanabe (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 299-303(1959). (In Japanese)

Extraction with 1% TBP in toluene from 8 to 10 N hydrochloric acid provides a method for the separation of zirconium and niobium from the slow neutron fission products of uranium. A synthetic mixture was prepared by adding Zr^{95}–Nb^{95} into an old fission products solution. From the mixture, Zr^{95}–Nb^{95} was recovered by 1% TBP extraction from 10 N hydrochloric acid. The fission products of uranium, irradiated in JRR-1 for 2 hr and cooled for one day,

were dissolved in 8 N hydrochloric acid and shaken with 1% TBP. The zirconium and niobium extracted were stripped from the organic phase with 0.5 N hydrochloric acid. Starting from a mixture of $Zr^{95}-Nb^{95}$, Ce^{141} and small amounts of other fission products, $Zr^{95}-Nb^{95}$ was isolated by a similar extraction from 10 N acid. (auth)

2471

SEPARATION METHODS FOR RADIOACTIVE ISOTOPES WITHOUT CARRIER. N. P. Rudenko. Khim. Nauka i Prom. 4, 441-8(1959). (In Russian)

A survey is given of methods for radioactive isotope separation from gaseous, liquid, or solid phases. 70 references. (R.V.J.)

2472

CO-CRYSTALLIZATION OF RADIOACTIVE SUBSTANCES WITH VARIOUS PRECIPITANTS. V. I. Grebenshchikova. Khim. Nauka i Prom. 4, 456-64(1959). (In Russian)

Data on co-crystallization of small amounts of radioactive substances with precipitant are analyzed and the equilibrium between solid and liquid phases is discussed. (R.V.J.)

2473

APPLICATIONS OF ION EXCHANGE CHROMATOGRAPHY IN SEPARATION OF TRANSURANIC AND RADIOACTIVE RARE EARTH ELEMENTS. B. K. Preobrazhenskiĭ. Khim. Nauka i Prom. 4, 521-6(1959). (In Russian)

A short review is given of the ion exchange chromatography method for separating tracer amounts of transuranic and radioactive rare earth elements. (R.V.J.)

2474

MINIMIZING FUEL-PROCESSING COSTS. Allan M. Poindexter (AMF Atomics, Greenwich, Conn.). Nucleonics 17, No. 11, 162; 164; 166; 168(1959) Nov.

The price policy of the Atomic Energy Commission for fuel reprocessing is given. Expressions are derived for optimum batch weight and minimum variable reprocessing cost ($/kg U). (C.J.G.)

2475

SEPARATION OF SMALL QUANTITIES OF NIOBIUM AND TITANIUM BY PYROGALLIC ACID. A. P. Savostin and I. P. Alimarin. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 111-19(1959). (In Russian)

Small quantities of niobium, in the presence of 100 and 1000 folds of titanium, were precipitated by pyrogallic acid in the presence of fluoride ion. It is shown that triple precipitation recovered 60 to 70% of the Nb. In the final precipitate the ratio of Nb : Ti was about 1 : 0.5 to 0.6, i.e., up to 2000 folds of enrichment. (R.V.J.)

2476

SEPARATION OF Nb AND Ti BY ION EXCHANGE CHROMOTOGRAPHY. I. P. Alimarin and N. P. Borzenkova. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 191-9(1959). (In Russian)

Niobium and titanium absorption by citric and sulfuric acid ionites was studied in order to determine their separation. Colorimetric recordings were taken of titanium absorption in hydrogen peroxide, and niobium absorption was checked radiometrically by Nb^{95} γ emission. (R.V.J.)

2477

IMPROVEMENTS IN OR RELATING TO PACKINGS FOR LIQUID-LIQUID CONTACTING COLUMNS. Philip Michael Cherubino Lacey (to United Kingdom Atomic Energy Authority). British Patent 823,378. Nov. 11, 1959.

A packing element for liquid-liquid extraction columns is offered. It consists of spheres of 0.625 in. diam arranged in a plane in point contact with each other in a square or hexagonal pattern. A stack of such spheres would present a face-centered cubic lattice. The element can be injection molded of polythene. A column can be so designed that these elements can be stacked in it with half-spheres in contact with the column, thus avoiding edge effects. The sub-elements may also be shapes other than spherical to give different column characteristics. (T.R.H.)

2478

SEPARATION OF SUBSTANCES PRESENT IN NEUTRON-IRRADIATED URANIUM. (to United Kingdom Atomic Energy Authority). British Patent 823,761. Nov. 18, 1959.

An ion-exchange chromatographic process for irradiated U is described. The U in HNO_3 solution is passed through a phenol formaldehyde resin column where U, Pu, and fission products are chromatographically adsorbed. The U is eluted by 0.2 M H_2CO_4, the fission products are removed by 0.6 M H_3PO_4 1 M in HNO_3, the Pu is then eluted by 0.8 M H_3PO_4 1 M in HNO_3. (T.R.H.)

2479

SEPARATION OF URANIUM FROM OTHER METALS. H. H. Hyman (to U. S. Atomic Energy Commission). U. S. Patent 2,893,822. July 7, 1959.

The separation of uranium from other elements, such as ruthenium, zirconium, niobium, cerium, and other rare earth metals is described. According to the invention, this is accomplished by adding hydrazine to an acid aqueous solution containing salts of uranium, preferably hexavalent uranium, and then treating the mixture with a substantially water immiscible ketone, such as hexone. A reaction takes place between the ketone and the hydrazine whereby a complex, a ketazine, is formed; this complex has a greater power of extraction for uranium than the ketone by itself. When contaminating elements are present, they substantially remain in the aqueous solution.

2480

SEPARATION OF URANIUM FROM THORIUM. N. N. Hellman (to U. S. Atomic Energy Commission). U. S. Patent 2,893,823. July 7, 1959.

A process is presented for separating uranium from thorium wherein the ratio of thorium to uranium is between 100 to 10,000. According to the invention the thorium-uranium mixture is dissolved in nitric acid, and the solution is prepared so as to obtain the desired concentration within a critical range of from 4 to 8 N with regard to the total nitrate due to thorium nitrate, with or without nitric acid or any nitrate salting out agent. The solution is then contacted with an ether, such as diethyl ether, whereby uranium is extracted into the organic phase while thorium remains in the aqueous phase.

2481

URANIUM RECOVERY PROCESS. H. H. Hyman and J. L. Dreher (to U. S. Atomic Energy Commission). U. S. Patent 2,893,824. July 7, 1959.

The recovery of uranium from the acidic aqueous metal waste solutions resulting from the bismuth phosphate carrier precipitation of plutonium from solutions of neutron irradiated uranium is described. The waste solutions consist of phosphoric acid, sulfuric acid, and uranium as a uranyl salt, together with salts of the fission products normally associated with neutron irradiated uranium. Generally, the process of the invention involves the partial

neutralization of the waste solution with sodium hydroxide, followed by conversion of the solution to a pH 11 by mixing therewith sufficient sodium carbonate. The resultant carbonate-complexed waste is contacted with a titanated silica gel and the adsorbent separated from the aqueous medium. The aqueous solution is then mixed with sufficient acetic acid to bring the pH of the aqueous medium to between 4 and 5, whereby sodium uranyl acetate is precipitated. The precipitate is dissolved in nitric acid and the resulting solution preferably provided with salting out agents. Uranyl nitrate is recovered from the solution by extraction with an ether such as diethyl ether.

2482

SEPARATION OF PROTACTINIUM FROM CONTAMINANTS. J. G. Malm and S. Fried (to U. S. Atomic Energy Commission). U. S. Patent 2,893,825. July 7, 1959.

The separation of protactinium by volatilization method is described. According to the invention, neutron irradiated finely divided thorium is reacted with aluminum trichloride or a mixture of aluminum trichloride and chlorine gas at a temperature of preferably between about 200 and 400°C. Following the chlorinating step the protactinium chloride along with aluminum chloride is selectively distilled from the mixture at a temperature of approximately 100°C. The protactinium chloride may be recovered from the mixture by treatment with sodium hydroxide, which converts the aluminum chloride to a soluble salt and forms insoluble protactinium hydroxide.

2483

SEPARATION OF AMERICIUM FROM PROMETHIUM. R. E. Pressly (to U. S. Atomic Energy Commission). U. S. Patent 2,893,827. July 7, 1959.

Promethium-147 is separated from americium in acidic aqueous solution by adding fluosilicic acid to the solution, heating the solution to form a promethium precipitate and separating the precipitate from solution. The precipitate is then re-dissolved by the addition of boric acid and nitric acid, and re-precipitated by the addition of fluosilicic acid. This procedure is repeated six or more times to obtain a relatively americium-free promethium precipitate. Americium may be separately recovered from the supernatant liquids. This process is applicable to the recovery of promethium from fission-product solutions which have been allowed to decay for a period of two to four years.

2484

PROCESS FOR REMOVING ALUMINUM COATINGS. J. Flox (to U. S. Atomic Energy Commission). U. S. Patent 2,893,863. July 7, 1959.

A process is presented for removing aluminum jackets or cans from uranium slugs. This is accomplished by immersing the aluminum coated uranium slugs in an aqueous solution of 9 to 20% sodium hydroxide and 35 to 12% sodium nitrate to selectively dissolve the aluminum coating, the amount of solution being such as to obtain a molar ratio of sodium hydroxide to aluminum of at least 1.65.

2485

PROCESS FOR CONTINUOUSLY SEPARATING IRRADIATION PRODUCTS OF THORIUM. L. P. Hatch, F. T. Miles, T. V. Sheehan, R. H. Wiswall, and R. J. Heus (to U. S. Atomic Energy Commission). U. S. Patent 2,893,936. July 7, 1959.

A method is presented for separating uranium-233 and protactinium from thorium-232 containing compositions which comprises irradiating finely divided particles of said thorium with a neutron flux to form uranium-233 and protactinium, heating the neutron-irradiated composition in a fluorine and hydrogen atmosphere to form volatile fluorides of uranium and protactinium and thereafter separating said volatile fluorides from the thorium.

2486

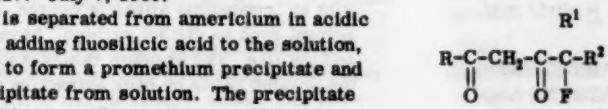
PROCESS OF EXTRACTING URANIUM AND RADIUM FROM ORES. C. W. Sawyer and R. W. Handley (to U. S. Atomic Energy Commission). U. S. Patent 2,894,804. July 14, 1959.

A process is presented for extracting uranium and radium values from a uranium ore which comprises leaching the ore with a ferric chloride solution at an elevated temperature of above 50°C and at a pH less than 4; separating the ore residue from the leaching solution by filtration; precipitating the excess ferric iron present at a pH of less than 5 by adding $CaCO_3$ to the filtrate; separating the precipitate by filtration; precipitating the uranium present in the filtrate at a Ph less than 6 by adding $BaCO_3$ to the filtrate; separating the precipitate by filtration; and precipitating the radium present in the filtrate by adding H_2SO_4 to the filtrate.

2487

SEPARATION PROCESS FOR ACTINIDE ELEMENTS AND COMPOUNDS THEREOF. L. B. Werner, I. Perlman, and M. Calvin (to U. S. Atomic Energy Commission). U. S. Patent 2,894,805. July 14, 1959.

This patent deals with the separation of americium and/or curium salts from lanthanum salt contained in an aqueous solution by contacting the latter, after adjustment of the pH to between 2 and 4.8, with an organic water-immiscible solution of a fluorinated β-diketone of the formula



wherein R is an alkyl, aryl, aralkyl, alkaryl or heterocyclic radical and R^1 and R^2 are hydrogen or fluorine; the americium and/or curium salt is selectively extracted as a chelate with the β-diketone. Americium and/or curium salt can also be separated by the same method from thorium salt contained in an aqueous solution, provided that the pH value is between 0.2 and 3; the thorium is chelated and extracted away from americium and curium.

2488

RECOVERY OF PROTACTINIUM FROM AQUEOUS SOLUTIONS. R. E. Elson (to U. S. Atomic Energy Commission). U. S. Patent 2,894,806. July 14, 1959.

The recovery of fluoride complexed protactinium from aqueous acidic solutions by solvent extraction is described. Generally the process of the invention comprises mixing an aqueous solution containing protactinium in a complexed form with an organic solvent which is specific for protactinium, such as diisopropyl carbinol, then decomposing the protactinium complex by adjusting the acidity of the aqueous solution to between 0.3 to 0.9 M in hydrogen ion concentration, and introducing a source of aluminum ions in sufficient quantity to establish a concentration of 0.5 to 1.2 M aluminum ion, whereupon decomposition of the protactinium fluoride complex takes place and the protactinium ion is taken up by the organic solvent phase.

2489

CATION EXCHANGE METHOD FOR THE RECOVERY OF PROTACTINIUM. M. H. Studier and J. C. Sullivan (to U. S. Atomic Energy Commission). U. S. Patent 2,894,807. July 14, 1959.

A cation exchange process is described for separating protactinium values from thorium values whereby they are initially adsorbed together from an aqueous 0.1 to 2 N hydrochloric acid on a cation exchange resin in a column. Then selectively eluting the thorium by an ammonium sulfate solution and subsequently eluting the protactinium by an oxalate solution.

2490

METHOD FOR RECOVERING URANIUM FROM OILS. L. H. Gooch (to U. S. Atomic Energy Commission). U. S. Patent 2,894,808. July 14, 1959.

A method is presented for recovering uranium from hydrocarbon oils, wherein the uranium is principally present as UF_4. According to the invention, substantially complete removal of the uranium from the hydrocarbon oil may be effected by intimately mixing one part of acetone to about 2 to 12 parts of the hydrocarbon oil containing uranium and separating the resulting cake of uranium from the resulting mixture. The uranium in the cake may be readily recovered by burning to the oxide.

2491

COLUMBIC OXIDE ADSORPTION PROCESS FOR SEPARATING URANIUM AND PLUTONIUM IONS. R. H. Beaton (to U. S. Atomic Energy Commission). U. S. Patent 2,894,810. July 14, 1959.

A process is described for separating plutonium ions from a solution of neutron irradiated uranium in which columbic oxide is used as an adsorbent. According to the invention the plutonium ion is selectively adsorbed by passing a solution containing the plutonium in a valence state not higher than 4 through a porous bed or column of granules of hydrated columbic oxide. The adsorbed plutonium is then desorbed by elution with 3 N nitric acid.

2492

DISSOLUTION OF PLUTONIUM CONTAINING CARRIER PRECIPITATE BY CARBONATE METATHESIS AND SEPARATION OF SULFIDE IMPURITIES THEREFROM BY SULFIDE PRECIPITATION. R. B. Duffield (to U. S. Atomic Energy Commission). U. S. Patent 2,894,812. July 14, 1959.

A process is described for recovering plutonium from foreign products wherein a carrier precipitate of lanthanum fluoride containing plutonium is obtained and includes the steps of dissolving the carrier precipitate in an alkali metal carbonate solution, adding a soluble sulfide, separating the sulfide precipitate, adding an alkali metal hydroxide, separating the resulting precipitate, washing, and dissolving in a strong acid.

2493

SOLVENT EXTRACTION OF RUTHENIUM. H. H. Hyman and G. R. Leader (to U. S. Atomic Energy Commission). U. S. Patent 2,894,816. July 14, 1959.

The separation of ruthenium from aqueous solutions by solvent extraction is described. According to the invention, a nitrite selected from the group consisting of alkali nitrite and alkaline earth nitrite in an equimolecular quantity with regard to the quantity of ruthenium present is added to an aqueous solution containing ruthenium tetranitrate to form a ruthenium complex. Adding an organic solvent such as ethyl ether to the resulting mixture selectively extracts the ruthenium complex.

2494

POLONIUM SEPARATION PROCESS. D. G. Karraker (to U. S. Atomic Energy Commission). U. S. Patent 2,894,817. July 14, 1959.

A liquid-liquid extraction process is presented for the recovery of polonium from lead and bismuth. According to the invention an acidic aqueous chloride phase containing the polonium, lead, and bismuth values is contacted with a tributyl phosphate ether phase. The polonium preferentially enters the organic phase which is then separated and washed with an aqueous hydrochloric solution to remove any lead or bismuth which may also have been extracted. The now highly purified polonium in the organic phase may be transferred to an aqueous solution by extraction with aqueous nitric acid.

2495

SEPARATION OF RUTHENIUM FROM AQUEOUS SOLUTIONS. M. Beederman, S. Vogler, and H. H. Hyman (to U. S. Atomic Energy Commission). U. S. Patent 2,894,818. July 14, 1959.

The separation of ruthenium from a ruthenium containing aqueous solution is described. The separation is accomplished by adding sodium nitrite, silver nitrate and ozone to the ruthenium containing aqueous solution to form ruthenium tetroxide and then volatilizing off the ruthenium tetroxide.

2496

URANIUM SEPARATION PROCESS. E. K. Hyde, L. I. Katzin, and M. J. Wolf (to U. S. Atomic Energy Commission). U. S. Patent 2,894,827. July 14, 1959.

The separation of uranium from a mixture of uranium and thorium by organic solvent extraction from an aqueous solution is described. The uranium is separated from an aqueous mixture of uranium and thorium nitrates 3 N in nitric acid and containing salting out agents such as ammonium nitrate, so as to bring the total nitrate ion concentration to a maximum of about 8 N by contacting the mixture with an immiscible aliphatic oxygen containing organic solvent such as diethyl carbinol, hexone, n-amyl acetate and the like. The uranium values may be recovered from the organic phase by back extraction with water.

2497

SEPARATION PROCESS FOR PROTACTINIUM AND COMPOUNDS THEREOF. A. Van Winkle (to U. S. Atomic Energy Commission). U. S. Patent 2,895,791. July 21, 1959.

The separation of protactinium from aqueous solutions from its mixtures with thorium, uranium and fission products is described. The process for the separation comprises preparing an ion nitric acid solution containing protactinium in the pentavalent state and contacting the solution with a fluorinated beta diketone, such as trifluoroacetylacetone, either alone or as an organic solvent solution to form a pentavalent protactinium chelate compound. When the organic solvent is present the chelate compound is extracted; otherwise it is separated by filtration.

2498

BARIUM RECOVERY PROCESS. R. E. Blanco (to U. S. Atomic Energy Commission). U. S. Patent 2,895,798. July 21, 1959.

A method of separating barium from nuclear fission products is described. In accordance with the invention, barium may be recovered from an acidic solution of neutron-irradiated fissionable material by carrying the barium out of solution as a sulfate with lead as a carrier and then dissolving the barium-containing precipitate in an aqueous solution of an aliphatic diamine chelating reagent. The barium values together with certain other metallic values present in the diamine solution are then absorbed onto a cation exchange resin and the barium is selectively eluted from the resin bed with concentrated nitric acid.

2499

EXTRACTION OF URANIUM. R. D. Kesler and D. D. Rabb (to U. S. Atomic Energy Commission). U. S. Patent 2,897,045. July 28, 1959.

An improved process is presented for recovering uranium from a carnotite ore. In the improved process U_3O_8 is added to the comminuted ore along with the usual amount of NaCl prior to roasting. The amount of U_3O_8 is dependent on the amount of free calcium oxide and the uranium in the ore. Specifically, the desirable amount of U_3O_8 is 3.2% for each 1% of CaO, and 5 to 6% for each 1% of uranium. The mixture is roasted at about 1560°C for about 30 min and then leached with a 3 to 9% aqueous solution of sodium carbonate.

2500

SEPARATION OF THORIUM FROM URANIUM BY EXTRACTION. E. G. Bohlmann (to U. S. Atomic Energy Commission). U. S. Patent 2,897,046. July 28, 1959.

A method is presented for the recovery and separation of uranium and thorium values contained in an aqueous nitric acid solution which is more than 3 M in nitric acid. The uranium and thorium containing solution preferable about 7 M in nitric acid is contacted with tributyl phosphate-kerosene mixture. Both U and Th are extracted by the immiscible organic. After phase separation the Th is selectively back extracted by contacting with an aqueous nitric acid solution preferably between 0.1 to 1.5 M in nitric acid. The uranium which is still in the organic extractant phase may be recovered by contacting with water.

2501

METHOD OF DISSOLVING METALLIC URANIUM. W. W. Schulz (to U. S. Atomic Energy Commission). U. S. Patent 2,897,047. July 28, 1959.

A process is presented for more rapidly dissolving metallic uranium which comprises contacting the uranium with a mixture of nitric and phosphoric acids. The preferred concentration is a mixture which is about 10 M in nitric acid and between 0.1 to 0.15 M in phosphoric acid.

2502

URANIUM RECOVERY PROCESS. J. W. Stevenson and R. G. Werkema (to U. S. Atomic Energy Commission). U. S. Patent 2,897,048. July 28, 1959.

The recovery of uranium from magnesium fluoride slag obtained as a by-product in the production of uranium metal by the bomb reduction process is presented. Generally the recovery is accomplished by finely grinding the slag, roasting the ground slag air, and leaching the roasted slag with a hot, aqueous solution containing an excess of the sodium bicarbonate stoichiometrically required to form soluble uranium carbonate complex. The roasting is preferably carried out at between 425 and 485°C for about three hours. The leaching is preferably done at 70 to 90°C and under pressure. After leaching and filtration the uranium may be recovered from the clear leach liquor by any desired method.

2503

ADSORPTION METHOD FOR SEPARATING THORIUM VALUES FROM URANIUM VALUES. G. E. Boyd, E. R. Russell, and J. Schubert (to U. S. Atomic Energy Commission). U. S. Patent 2,898,185. Aug. 4, 1959.

An improved ion exchange method is described for recovery of uranium and thorium values as separate functions from an aqueous acidic solution containing less than 10^{-3} M thorium ions and between 0.1 and 1 M uranyl ions. The solution is passed through a bed of cation exchange resin in the acid form to adsorb all the thorium ions and a portion of the uranyl ions. The uranium is eluted by means of aqueous 0.1 to 0.4 M sulfuric acid. The thorium may then be stripped from the resin by elution with aqueous 0.5 M oxalic acid.

2504

SOLUBILIZATION OF ACTINIDE METAL-CONTAINING SLAG. H. H. Hopkins, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,898,186. Aug. 4, 1959.

This patent relates to solubilization of the actinide rare earths valves contained in the slag materials resulting from the reduction of actinide salts, such as plutonium tetrafluoride. According to the invention the slag is subjected to a high temperature chloridizing roast, preferably at about 700°C with gaseous hydrogen chloride, until the actinides within the slag are substantially converted to the chlorides. The resultant chlorinated actinides are then leached from the cooled roasted mass by treating with aqueous 0.01 M nitric acid.

2505

RECOVERY OF URANIUM FROM AQUEOUS PHOSPHATE-CONTAINING SOLUTIONS. I. Igelsrud and E. F. Stephen (to U. S. Atomic Energy Commission). U. S. Patent 2,899,268. Aug. 11, 1959.

A method is presented for recovering hexavalent uranium from an acidic phosphate solution. A high molecular weight amine, such as a mixture of cocoanut oil amines, is added to the solution in such amount as to give a ratio of about 2000 parts by weight of amine to 1 part by weight of uranium. The uranium is precipitated with the amines and the whole filtered from the solution. The uranium is leached from the amine mass by washing with aqueous sodium carbonate solution; and the amine mixture is available for reuse.

2506

RECOVERY OF URANIUM BY AROMATIC DITHIOCARBAMATE COMPLEXING. O. K. Neville (to U. S. Atomic Energy Commission). U. S. Patent 2,899,451. Aug. 11, 1959.

A selective complexing organic solvent extraction process is presented for the separation of uranium values from an aqueous nitric acid solution of neutron irradiated thorium. The process comprises contacting the solution with an organic aromatic dithiocarbamate and recovering the resulting uranodithiocarbamate complex with an organic solvent such as ethyl acetate.

2507

THORIUM OXALATE–URANYL ACETATE COUPLED PROCEDURE FOR THE SEPARATION OF RADIOACTIVE MATERIALS. J. W. Gofman (to U. S. Atomic Energy Commission). U. S. Patent 2,899,452. Aug. 11, 1959.

The recovery of fission products from neutron-irradiated uranium is described. The neutron-irradiated uranium is dissolved in acid and thorium oxalate is precipitated in the solution formed, whereby the fission products are carried on the thorium oxalate. The separated thorium oxalate precipitate is then dissolved in an aqueous oxalate solution and the solution formed is acidified, limiting the excess acidity to a maximum of 2 N, whereby thorium oxalate precipitates and carries lanthanum-rare-earth- and alkaline-earth-metal fission products while the zirconium-fission-product remains in solution. This precipitate, too, is dissolved in an aqueous oxalate solution at elevated temperature, and lanthanum-rare-earth ions are added to the solution whereby lanthanum-rare-earth oxalate forms and the lanthanum-rare-earth-type and alkaline-earth-metal-type fission products are carried on the oxalate. The precipitate is separated from the solution.

ENGINEERING AND EQUIPMENT

General and Miscellaneous

2508 AECU-4440

Franklin Inst. Labs. for Research and Development, Philadelphia.

A BIBLIOGRAPHY ON GAS LUBRICATED BEARINGS–REVISED. Interim Report. Eugene B. Sciulli. Sept. 15, 1959. 108p. Sponsored by DOD; AEC; Maritime Administration; and NASA under Contract Nonr-2342(00). (I-A2049-6). OTS.

A compilation of 290 references on gas bearings is presented. In most cases an English résumé of each reference is included, a translation being made when required. The references are arranged alphabetically by first author. Indexes included are the year of origin, corporate author, subject, patent number, and country of origin. (J.R.D.)

2509 NASA-TN-D-197

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

LUBRICATION OF CORROSION-RESISTANT ALLOYS BY MIXTURES OF HALOGEN-CONTAINING GASES AT TEMPERATURES UP TO 1200°F. Donald H. Buckley and Robert L. Johnson. Nov. 1959. 30p. OTS.

CF_2Br_2, CF_3Br, CHF_2Br, and SF_6 gases were used to lubricate nickel- and cobalt-base alloys at temperatures up to 1200°F. A hemispherically tipped rider ($^3/_{16}$-in. rad.) under a 1200g load slid on a rotating disk at various speeds. A 1:1 gas blend of CF_2Br_2 and CF_3Br was the optimum mixture to lubricate Stellite 98M2 sliding on Hastelloy C, and Inconel X on Rexalloy 33. Reaction mechanisms in reactive gas lubrication were used to select suitable metal-gas combinations for lubrication systems. (auth)

2510 NP-tr-305

SYNTHETIC LUBRICATING OILS. A. I. Dintses and A. V. Druzhinina. Translation of "Sinteticheskie Smazochnye Masla." 1958. 376p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 17091.

2511

LARGE IRRADIATION SOURCES IN INDUSTRY. S. Jefferson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Atomwirtschaft 4, 444-47(1959) Oct. (In German)

The first large industrial equipment for irradiation using radioactive isotopes contains 150,000 curies of Co-60. Further installations are planned, in particular for the sterilization of textile fibers and medical equipment. Spent reactor fuel elements are of limited suitability for irradiation purposes. (auth)

2512

ELECTRON IRRADIATION PROCESSES IN WIRE AND CABLE PRODUCTION. D. A. Trageser (High Voltage Engineering Corp., Burlington, Mass.). Atomwirtschaft 4, 447-9(1959) Oct. (In German)

In the wire and cable industries production processes involving irradiation from electron accelerators are especially applied to the cold vulcanizing of silicon tapes and to the controlled placement of cross links in polyethylene sheaths of insulated cables. The correct choice of radiation energy and irradiation geometry governs the efficiency. (auth)

2513

THE CONSTRUCTION OF RADIOISOTOPE CARRIERS FOR GAMMAGRAPHIC PURPOSES. R. A. Jonkers. Atoomenergie 1, 167-70(1959) Oct. (In Dutch)

The principles of gammagraphy and the required characteristics of radiation sources used are briefly described. The construction of various types of holders and carriers of radiation sources is then discussed. (tr-auth)

2514

STUDY OF GAS-LUBRICATED, HYDRODYNAMIC, FULL JOURNAL BEARINGS. S. Whitley and C. Betts (U.K.A.E.A., Capenhurst, Ches., Eng.). Brit. J. Appl. Phys. 10, 455-63 (1959) Oct.

The two most important characteristics of gas-lubricated, full journal bearings are load-carrying capacity and half-speed whirl. These two characteristics have been investigated. The gases used as lubricants were mainly hydrogen, nitrogen, and neon, giving a large viscosity variation. Argon and carbon dioxide were also used to investigate the effect of the ratio of specific heats (γ). The bearings used were plain cylinders with a longitudinal groove cut into the upper surface of each bearing, extending over half the bearing length. It has been shown that this groove improved the half-speed whirl characteristics, and tests on bearings without the groove, demonstrate that the groove does not affect the load capacity. The parameters investigated are bearing length, diameter, clearance, rotational velocity, ambient pressure, and the gas viscosity and ratio of specific heats. It is shown that, in general, the existing theories of load performance for compressible lubricants, operating in isothermal conditions, give a satisfactory correlation with the experimental results. The half-speed whirl results are not related to a complete analytical theory, but useful stability criteria are established. (auth)

2515

THE UTILIZATION OF RADIOACTIVE ISOTOPES IN THE RUBBER AND PLASTICS INDUSTRY. H. E. Jahn. Kautschuk u. Gummi 11, No. 4, WT102, WT104, WT106, WT108 (1958). (Translated from Referat. Zhur. Khim. No. 8, 1959, Abstract No. 29701)

The properties of Co^{60}, Cs^{137}, Ir^{192}, Sr^{90}, Tl^{204}, and Tm^{170} are discussed together with the applications of radioactive radiation in the sterilization of products, in thickness measurements, and in the modification of plastics (including radiation vulcanization). Measurement of resistance to aging is discussed as well as radiation shielding and the definition of radiation units and doses.

2516

HUMIDITY CONTROL DURING BOILER ERECTION. A. S. Miller (Denco Miller, Ltd., Hereford, Eng.). Nuclear Eng. 4, 404-5(1959) Nov.

A design is given for a dehumidification plant to be used for humidity control during boiler erection. The plant was designed with an operating dew-point temperature of −10°F, a maximum airflow of 2,500 efm, and a controlled outlet temperature of 50 to 60°F. The system employs the regenerative heat pump cycle to condition the air and is designed for non-recirculation. (C.J.G.)

2517

THE USE OF RADIACTIVE ISOTOPES IN THE SOVIET BUILDING MATERIALS INDUSTRY. S. Reinsdorf and H. Cermak. Silikat Tech. 9, No. 4, 165-9(1958). (Translated from Referat. Zhur. Khim. No. 8, Abstract No. 28320).

Applications of radioactive isotopes in the USSR in the

control of production processes such as charging of rotary kilns and silos, travel rate of materials through rotary kilns and ball mills, wear of furnace linings, and flow rate of gases are described. Also, quality control applications such as defects in reinforced concrete structures, strength tests on concrete, investigation of the gamma-shielding characteristics of concrete, and in studies on the rate of hydration of cement as well as in chemical analysis are described.

Heat Transfer and Fluid Flow

2518 ANL-6060
Purdue Univ., Lafayette, Ind.
HIGH-FLUX HEAT TRANSFER STUDIES: AN ANALYTICAL INVESTIGATION OF LAMINAR FILM BOILING. P. W. McFadden and R. J. Grosh. Oct. 1959. 59p. For Argonne National Lab. Contract W-31-109-eng-38, Subcontract 704. OTS.

An analysis was made of stable, laminar, free convection, film boiling from isothermal vertical plates and horizontal cylinders surrounded by a saturated liquid, where radiation was only of minor importance. The mathematical techniques of boundary layer theory were used and the boundary layer equations were reduced to ordinary differential equations by means of a transformation similar to those used in free convection and condensation. The equations were solved for: (1) compressible flow with variable specific heat, (2) variable specific heat and density variations considered only in the evaluation of the buoyant force, and (3) the case of constant properties. Numerical results were obtained for: (1) near critical water at 2800 and 3100 psia with wall to liquid temperature differences of 250, 500, and 1000°F; (2) for fluids with Prandtl numbers of ⅔, 1, and 2; and (3) for mercury and methanol film boiling at one atmosphere, considering constant properties. The results obtained by assuming constant properties were compared to: (1) the results obtained by considering variable properties, (2) experimental results, and (3) the comparable case of laminar film condensation. It was shown that the method of considering density variations only in the evaluation of the buoyant force is not valid in film boiling. It was also shown that the constant-property solutions for heat transfer did not always agree with solutions obtained considering compressible flow and variable specific heat. An approximate analysis of a non-isothermal wall, including the effects of radiation, was presented. It was shown that for high emissivity walls at high temperature, radiation is the controlling factor in film boiling heat transfer. (auth)

2519 CF-59-11-1
Oak Ridge National Lab., Tenn.
FLOW STABILITY IN HEAT TRANSFER MATRICES UNDER BOILING CONDITIONS. A. P. Fraas. Nov. 1, 1959. 17p. OTS.

The stability of fluid flow for cases in which boiling occurs in parallel passages had posed questions of design feasibility recently in several areas including once-through steam generators for large gas-cooled reactors, water-cooled reactors such as the MTR, and small compact reactors cooled by a boiling alkali metal. A survey of the literature disclosed a number of treatments of the subject, but there appears to be no comprehensive presentation that makes it easy for the designer to envision the regions under which stable flow conditions would prevail. Most of the conditions of interest are covered with a few charts which were prepared to provide the necessary information for the designer. These charts are presented together with the method used to develop them. (auth)

2520 DP-380
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
ROUGHENING OF HEAT TRANSFER SURFACES AS A METHOD OF INCREASING THE HEAT FLUX AT BURNOUT. Progress Report No. 1. William S. Durant and Samuel Mirshak. July 1959. 21p. Contract AT(07-2)-1. OTS.

The heat flux at burnout for rough surfaces that are cooled by forced flow of water in annuli was shown experimentally to be at least 50 to 100% greater than for smooth surfaces at the same coolant velocity, temperature, and pressure. By roughening the heat transfer surface of a fuel assembly and by increasing the size of the coolant passages, a net gain of as much as 80% in heat flux at burnout may be realized without increasing the power required to pump the coolant through the assembly. The tests were conducted with electrically heated tubes that were cooled by forced convection boiling of water in annuli surrounding the tubes. The tubes were roughened with knurls or threads to a depth of 0.005 to 0.013 in. (auth)

2521 KAPL-RDTR-308(Pt. VI)
Knolls Atomic Power Lab., Schenectady, N. Y.
DNB REGRESSION LINE FOR A MATRIX OF OVAL TWISTED RIBBONS WITH VERTICAL UPFLOW OF WATER AT 2000 PSIA. R. C. Dowling. [1958]. 27p. OTS.

DNB data for a matrix of oval twisted ribbons were obtained by SAR Reactor Engineering during tests at ANL, Columbia University, and Bettis. The flow of water was upwards at 2000 psia. Results of the Columbia and Bettis tests are presented and a least squares regression line is fitted to the data. (J.R.D.)

2522 MND-E-2155
Martin Co. Nuclear Div., Baltimore.
TRANSIENT NONCONDUCTIVE HEAT TRANSFER AND STEAM FORMATION. R. Magladry. Oct. 1959. 45p. Contract DA-44-009-ENG-3633.

The rates of nonconductive heat transfer and steam formation associated with transient local boiling in pool reactors are examined by use of macroscopic temperature and pressure measurements. The results can be used to provide conservative bases for operation or design limitations on the transient behavior of reactors having pumped flow. Measurements were made at the Spert I facility using SM-1-type fuel elements. Results are tabulated. (J.R.D.)

2523 NAA-SR-Memo-2354
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMR FINNED FUEL PLATE. R. R. Hargrove and C. R. Davidson. Jan. 24, 1958. 10p. OTS.

Studies were made to determine the pressure drop and friction factors for a section of the proposed OMR finned plate fuel element for flow rates ranging from 30 to 130 gpm. Three elements were tested and differed only in plate spacings, number of plates, and flow channel areas. Fluid Santowax-R was the fluid used. (W.L.H.)

2524 NAA-SR-Memo-3860
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CALCULATED BURNOUT HEAT FLUXES FOR SANTOWAX-R. E. Baumeister. May 14, 1959. 8p. OTS.

Studies were made to determine the burnout heat fluxes for Santowax-R at various pressures, bulk temperatures, Reynolds numbers, and high boiler compound. Plots of the burnout heat flux for Santowax-R are given. These values were obtained using the lower limit of the Griffith correlation. (W.L.H.)

2525

A CRITICAL SURVEY OF THE LITERATURE ON BURNOUT STUDIES WITH WET STEAM. A. Cicchitti, M. Silvestri, G. Soldaini, and R. Zavattarelli (Centro Informazione Studi Esperienze, Milan). Energia nucleare (Milan) 6, 637-60(1959) Oct.

Experimental data and studies on the burnout phenomenon with steam-water mixture are considered. A new correlation of burnout heat flux data is proposed and a comparison between the existing correlations and the proposed correlation is made. Moreover, the first burnout heat flux data obtained with the experimental facility CISE-Edisonvolta are reported. (auth)

2526

EXPERIMENTAL STUDIES OF THE BOILING PHENOMENA. I. THE DENSITY DISTRIBUTION OF STEAM–WATER MIXTURE IN THE MULTIPLE RECTANGULAR CHANNELS UNDER ATMOSPHERIC PRESSURE. R. Saitō and H. Yamaki (Hitachi, Ltd., [Japan]). J. Atomic Energy Soc. Japan 1, 40-45(1959) June. (In Japanese)

To study the water boiling phenomena under atmospheric pressure, a natural circulation loop with multiple rectangular channels was constructed for observing the behavior of steam bubbles and for measuring the distribution of voids in the heated sections by the gamma-ray attenuation method. The relative velocities of steam-water were evaluated from the results obtained. The precise effects of the channel width on the bubble size and the relative velocity of steam-water could not be obtained, but the general characteristics of boiling were observed. Upon comparing the results of the experiments with calculations based on the Behringer's and Johnson's data, slight deviations were found, especially when compared with the Behringer's data. It is concluded that the effect of the inlet velocity on the relative velocity must be taken into account, and that special attention is necessary in applying the Behringer's data to practical design, at least under atmospheric pressure. (auth)

2527

GAS-SIDE HEAT TRANSFER INVESTIGATIONS. D. A. Barnard, N. Cherrett, and G. D. Robinson (Wrightson and Co., Ltd., Thornaby, Yorks, Eng.). Nuclear Eng. 4, 394-9(1959) Nov.

Experimental heat transfer facilities for determining friction factors for flow across banks of extended surface tubes and the influence of various parameters such as tube size and pitching on boiler dimensions are described. A design is given for a pressurized high-temperature rig from which very accurate results were obtained. Axial flow matrices, i.e., axially finned tubes and transversely finned tubes with gas in axial flow were found unsuitable for use in nuclear boilers. Heat transfer and pressure-drop correlations are given for cross-flow bundles. In row-by-row heat transfer measurements, a sharp fall in heat transfer coefficient over the last row was observed. (C.J.G.)

2528

IMPROVEMENTS IN WATER-TUBE STEAM BOILERS. Andre Huet. British Patent 823,904. Nov. 18, 1959.

A water-tube boiler design is offered which consists of a central water container with several smaller casing ducts with individual tube sections. (T.R.H.)

Instrumentation

2529 AECU-4454

Lockheed Nuclear Products, Marietta, Ga.

BACKSCATTER GAGING DEVICE. Mid-term Status Report. B. C. Rusche. Nov. 1959. 20p. Contract AT(30-1)-2428. (NR-79). OTS.

The necessary equipment for the Radioisotope Gaging Experiment has been assembled. Initial experiments with both a 1 μc and a 50 μc cesium-137 source demonstrated the presence of backscattered photons in the 0.15 Mev energy range. A theoretical study verified the existing probe design as near optimum. Detailed experiments on the scattering mechanisms will be required to further refine the probe geometry. Principal gain is expected in the choice of scintillator crystal geometry and sources. (auth)

2530 AECU-4458

Illinois. Univ., Urbana. Engineering Experiment Station.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 14 [for] June 1, 1959 to September 1, 1959. P. D. Coleman, W. L. Emery, J. R. Baird, R. C. Becker, B. W. Hakki, R. J. Kenyon, J. J. Stafford, and A. W. Swago. Oct. 1, 1959. 78p. Contract AT(11-1)-392. OTS.

Status of the work on the theory of frequency conversion, studies of non-linear phenomena and multipliers, and millimeter wave components are indicated. (See also AECU-4199). (W.D.M.)

2531 AERE-R-2994

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

BASIC DESIGN PARAMETERS FOR HIGH FREQUENCY POWER AMPLIFIERS. F. M. Russell. Aug. 1959. 30p. BIS.

At high power levels inductive coupling systems are the most successful and the procedure for the design of a complete stage is given. Use is made of an equivalent circuit. By the introduction of an equivalent inductance it is shown how the theory of lumped element circuits can be applied to circuits using distributed elements. In the appendices some useful data is given relating to the measurement of Q and the pulse operation of valves. (auth)

2532 AERE-R/M-119

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A LARGE FISSION CHAMBER DESIGNED FOR USE AS A CURRENT CHAMBER. R. Aves, A. R. Baker, D. Barnes, and R. D. Smith. May 1957. 9p.

A large fission chamber containing a set of parallel-plate electrodes coated with 8g of U^{235} was constructed. The design and performance are described. When placed in a thermal neutron flux of 10^6 cm/sec, the ionization current is 2 μa. (auth)

2533 AFBMD-TR-59-6

Avco Corp. Avco-Everett Research Lab., Everett, Mass.

THE LARGE HIGH PRESSURE ARC PLASMA GENERATOR: A FACILITY FOR SIMULATING MISSLE AND SATELLITE RE-ENTRY. Research Report 56. P. Rose, W. Powers, and D. Hritzay. June 1959. 35p. Contracts AF04(647)-278 and AF04(645)-18.

The development of an arc wind tunnel capable of stagnation pressures in the excess of twenty atmospheres and using as much as fifteen megawatts of electrical power is described. The calibration of this facility shows that it is capable of reproducing the aerodynamic environment encountered by vehicles flying at velocities as great as satellite velocity. Its use as a missile re-entry material test facility is described. The large power capacity of this facility allows one to make material tests on specimens of size sufficient to be useful for material development yet at realistic energy and Reynolds number values. By the addition of a high-capacity vacuum system, this facility can be used to produce the low density, high Mach number environment needed for simulating satellite re-entry, as well as hypersonic flight at extreme altitudes. (auth)

2534 ARF-1152-5

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN IMPROVED NUCLEAR DENSITY GAUGE. Period covered: October 2 to November 1, 1959. G. M. Burgwald. 3p. Contract AT(11-1)-745. OTS.

Progress is reported on development of a scintillation detector which alternately views the radiation transmitted through a sample and through a calibrated wedge. From this information density and thickness data can be obtained. Long term stability measurements are being made on the commutating system and the causes of fluctuations are being investigated. Information concerning procurement and fund expenditure are given. (J.R.D.)

2535 CF-54-7-187

Oak Ridge National Lab., Tenn.

TEST RESULTS AND DESIGN COMPARISONS FOR LIQUID METAL-TO-AIR RADIATORS. H. J. Stumpf, R. E. MacPherson, and J. G. Gallagher. July 19, 1954. Decl. Oct. 9, 1959. 84p. Contract W-7405-eng-26. OTS.

Test data for an ORNL radiator core element with 14 strip fins per inch Colburn modulus j and friction factor f for the test unit are plotted against Reynolds number and compared with data for other compact surface heat exchangers. In addition, a time saving method for designing liquid metal-to-air radiators is presented. (L.T.W.)

2536 CF-54-11-69

Oak Ridge National Lab., Tenn.

TEMPERATURE-TIME HISTORY AND TUBE STRESS STUDY OF THE INTERMEDIATE HEAT EXCHANGER TEST. R. J. Gray. Nov. 30, 1954. Decl. Oct. 9, 1959. 13p. OTS.

A complete temperature-time history of sodium and fluoride flow passes of the intermediate heat exchanger test is presented. Data are given in the form of plots of sodium temperatures and fluoride temperatures in the exchanger versus time of operation. (J.E.D.)

2537 CF-56-5-148

Oak Ridge National Lab., Tenn.

METALLOGRAPHIC EXAMINATION OF HIGH VELOCITY HEAT EXCHANGER (SHE NO. 1). R. J. Gray. May 24, 1956. Decl. Oct. 9, 1959. 14p. OTS.

Judging from the condition of the tube walls, this heat exchanger was close to failure. The depth of intergranular attack on the inner NaK surface (0.003 in.) and the depth of subsurface voids on the fuel side (0.007 in.) were more than half the wall thickness and these measurements were only from a few scattered specimens and on one plane per specimen. The grain size was much larger in the hot end than in the cold end of the heat exchanger. This increased grain size in the hot end could be attributed to the absence of precipitate and greater triaxial stresses due to thermal expansion and a thermal differential across the tube wall. Also, the strain anneal effect due to the thermal cycling during operation at a specific temperature would accelerate grain growth. These stress conditions and the resulting change in microstructures are directly related to the operating temperature at the hot end. The greater depth of corrosion at the hot end could also be due to a greater stressed condition or a corrosion fatigue. Mass transfer was present where the NaK entered the heat exchanger, but this deposition was influenced greatly by flow against the tube walls. The maximum deposit was 0.003 in. (auth)

2538 CF-56-7-135

Oak Ridge National Lab., Tenn.

EXAMINATION OF ORNL 1 AND 2 INTERMEDIATE HEAT EXCHANGERS, TYPE IHE-3. J. H. DeVan and R. S. Crouse. July 20, 1956. Decl. Oct. 9, 1959. 17p. OTS.

Failure, which resulted in the stoppage of fluoride flow in ORNL No. 1, occurred as a NaK to fuel leak in the vicinity of the NaK inlet heater. The reaction of NaK with fuel at this point caused the deposition of nearly pure UF_3 around the tubes and, finally, a sufficient increase in the melting point of the fuel to produce solidification. Fluorides throughout the heat exchangers were found to be depleted in uranium and to contain some potassium. Thus it would appear that stoppage of flow occurred after considerable NaK pick-up had taken place. Fluoride attack observed in these heat exchangers, with the exception of the area of failure, agreed substantially with what would be predicted from other dynamic systems. However, in those tubes near the point of failure, attack on the "tension" side of the tubes occurred to depths approximately twice those observed in "unstressed" tubes at comparable temperatures. Mass transferred particles were present in the NaK circuit of ORNL No. 1 to a maximum thickness of 15 mils. Deposit thicknesses varied markedly from header to header. (auth)

2539 NAA-SR-Memo-3138

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TIME BASE GENERATOR FOR OMR CRITICAL EXPERIMENT. L. S. Beller. Oct. 20, 1958. 8p. OTS.

An accurate time standard is needed for the instrumentation of the OMR Critical Experiment. An instrument has been obtained and calibrated. The instrument consists of a temperature controlled crystal oscillator operating at one megacycle, a sloper, and a divider chain. (W.L.H.)

2540 NAA-SR-Memo-3308

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SCINTILLATION DETECTOR AND PREAMPLIFIER UNIT FOR GENERAL COUNTING ROOM USE, A. I. CRITICAL EXPERIMENT LABORATORY. L. S. Beller. Dec. 5, 1958. 7p. OTS.

Scintillation counting techniques were chosen for a critical experiment laboratory. Three detector units were built and tested. They are exceptionally stable mechanically. The unit has sufficient sensitivity and signal to noise ratio to detect reliably from thin stilbene crystals. The system has sufficient resolution for gamma spectrum analysis. The output will drive up to 500 feet of G-62/U cable with good linearity. (W.L.H.)

2541 NAA-SR-Memo-3863

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

METHOD FOR DETERMINATION OF LIQUID DENSITY AND VISCOSITY OF ORGANIC COOLANTS OVER THE

TEMPERATURE RANGE (M.P. TO 850°F). G. Asanovich. May 14, 1959. 12p. OTS.

Techniques were developed to measure the liquid density and viscosity of organic coolants over the temperature range 300 to 850°F. (W.L.H.)

2542 NP-8027

Texas Instruments, Inc. Central Research Labs., Dallas.
PROPOSAL FOR METHOD OF DETERMINING AMOUNTS OF K^{40}, URANIUM, AND THORIUM IN THE NEAR SURFACE LAYERS OF THE MOON. R. S. Foote and J. A. F. Gerrard. Mar. 20, 1959. 30p.

A method is outlined for determining the amounts of potassium-40, uranium, and thorium in the surface layers of the moon and for obtaining energy-level and intensity measurements along the flight path. A type of monitoring system is described with a discussion on the required telemetry-information link. (W.L.H.)

2543 NP-8053

Brooklyn. Polytechnic Inst. Microwave Research Inst.
QUARTERLY PROGRESS REPORT NO. 15 [FOR] JANUARY 15, 1959 THROUGH APRIL 14, 1959 TO THE JOINT SERVICES TECHNICAL ADVISORY COMMITTEE. Report R-452.15-59. Ernst Weber. 104p. Contract AF18(600)-1505.

The Electrophysics Group is engaged in research efforts primarily in microwave electromagnetics, electronics, and solid state physics. Theoretical and experimental programs are reported on microwave tubes, non-conventional waveguides, quasi-optics and multimodes, and field theoretic calculations. The Networks and Waveguides Group is concerned with the general study of lumped and distributed parameter networks and the application of such studies to the design of devices with optimum terminal performance, particularly in the microwave and millimeter wavelength regions. The Systems and Control Group is concerned with the properties and design of various portions of a communication or control system. Emphasis is placed on the interaction and interrelation of component parts which govern the characteristics of the over-all system. (W.D.M.)

2544 NP-8058

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.
HODOSCOPE SYSTEM OF GEIGER COUNTERS WITH CONTROLLED PULSE SUPPLY FOR INVESTIGATION OF π^--PROTON SCATTERING. I. M. Vasilevskii (Vasilevsky) and V. V. Vishnyakov. 1959. 13p. (P-287).

The hodoscope system of gas-discharge counters with controlled pulse supply which was used on the synchrocyclotron for investigation of π^--proton scattering is described. The system consisted of 426 hodoscope counters. The details of the use of such systems in some experiments made on accelerators are given. (auth)

2545 NP-8059

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.
SEMI-AUTOMATIC COMPARATOR FOR EVALUATION OF STEREOPHOTOGRAPHS. 1959. A. I. Filippov, M. M. Kulyukin, Yu. A. Shcherbakov, R. M. Sulyaev, and A. T. Vasilenko. 1959. 18p. (P-361).

A device for stereophotograph evaluation is described which provides for simultaneous measurement of three space co-ordinates of the track point and automatic tape punching. The principle of operation is that a reference mark is projected on the film and observed through a stereomagnifier. (W.D.M.)

2546 NP-8066

Brooklyn. Polytechnic Inst. Microwave Research Inst.
PROGRESS REPORT NO. 16 [FOR] APRIL 15, 1959 THROUGH SEPTEMBER 14, 1959 TO THE JOINT SERVICES TECHNICAL ADVISORY COMMITTEE. Report R-452.16-59. Ernst Weber. 150p. Contract AF18(600)-1505.

Research efforts by the Electrophysics Group in microwave electromagnetics, electronics, and solid state physics are summarized. General studies of lumped and distributed parameter networks and the application of such studies to the design of devices with optimum terminal performance are reported. New and improved components employing special waveguide geometries, and the interaction of guided waves with solid state materials to yield novel circuits were of special interest. The properties and design of various portions of a communication or control system are considered. (For preceding period see NP-8053.) (W.D.M.)

2547 PIB-691

Brooklyn. Polytechnic Inst. Microwave Research Inst.
REFLEX MULTIPACTOR EFFECT. B. Epsztein. Sept. 22, 1959. 18p. Contract AF18(600)-1505. (AFOSR-TN-59-1103).

A theoretical study was made of a new type of multipactor which can take place on a single surface in the presence of a tangential d-c magnetic field. The analysis shows that the presence of this effect depends only on the ratio of the cyclotron frequency corresponding to the applied magnetic field to the operating frequency once a threshold for the r-f field is reached. The value of this threshold depends on the secondary emission properties of the surface. Conditions for stable reflex multipactor are given. (auth)

2548 RFP-162

Dow Chemical Co. Rocky Flats Plant, Denver.
SINGLE-CHANNEL GAMMA RAY SPECTROMETER, MODEL G-1. J. R. Mann. Nov. 24, 1959. 32p. Contract AT(29-1)-1106. OTS.

The model G-1 is a single-channel gamma-ray spectrometer of the sliding discriminator type. A versatile scintillation type detector consisting of several sizes NaI(Tl) crystals and an RCA 6655A multiplier phototube is used with the instrument. The construction, operation, and applications of the instrument are described. Maximum input count rate for zero distortion is 60,000 counts per minute. Half-height energy resolution of 0.662-Mev gammas is approximately 8%. The pulse resolving time is 3 μsec. (auth)

2549 SCTM-282-58(52)

Sandia Corp., Albuquerque, N. Mex.
"TRA-DECOM"—MODEL A (A TRANSISTORIZED PAM DECOMMUTATOR). P. R. Palmer, J. E. Scheibner, R. L. Shaum, and R. A. Glenn. Sept. 9, 1958. 71p. Contract AT(29-1)-789. OTS.

A compact transistorized 32-channel decommutator system is described that accepts PAM commutation from an airborne telemetering system, and by controlled time sequencing, isolates and integrates each channel of information. Each individual channel of information is presented as a separate output to drive high-current recording devices. Since low-level switching pulses are not required, "airborne" commutation is made simple. The "TRA-DECOM" will operate equally well on the standard 18- or 30-channel system. (auth)

2550 USNRDL-TR-365

Naval Radiological Defense Lab., San Francisco.
AUTOMATIC COMPENSATION OF DEADTIME IN COUNTING EQUIPMENT. D. F. Covell, M. M. Sandomire, and M. S. Eichen. Sept. 14, 1959. 19p.

For accurate estimation of emission rates of radioactive

samples, one must ordinarily estimate the deadtime parameter of the counting system over the energy and rate range of interest. Deadtime correction factors, once determined, may be laborious to apply, and, in any event, detract from the precision of the estimate of the rate because of the uncertainty of the correction factor itself. A device is described which provides a statistical estimate of the actual sampling time during any counting interval. (auth)

2551 Y-1275

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. PRODUCTION LEAK RATE DETECTION SYSTEMS. Harry S. Corey, III. Apr. 13, 1959. 27p. Contract W-7405-eng-26. OTS.

A discussion of the evolution of leak rate determination methods and systems, for the routine checking of sealed assemblies on a production basis in the Y-12 Plant, is presented. (auth)

2552

IONIZATION CHAMBER FOR X-RAY DIFFRACTION MEASUREMENTS IN THE PRESENCE OF STRONG RADIOACTIVITY. Lassi Hyvärinen. Ann. Acad. Sci. Fennicae Ser. A VI, No. 29, 1-54(1959).

A method of monachromating x rays by means of balanced filters is presented. The procedure is based on the similarity of absorption spectra of different elements in the x-ray region. The absorption can be equalled for all wavelengths of interest except in a narrow band of wavelengths between the K-absorption edges. The difference of intensities passing the two filters separately is obtained as an a-c component of the ionizing current. The estimated sensitivity of the ionization chamber is about 600 quanta per second of the monochromatic radiation. The system proved to be linear with intensities of 1.4×10^7 quanta per second (tube used does not permit ratings over 30kv and 10ma). Methods are given for diffraction measurements on highly radioactive materials and the measurement of x rays emitted by radioactive nuclei. A theoretical discussion is given on the instrument and its effectivness is compared to conventional detectors. (C.J.G.)

2553

A SIMPLE DOUBLE PULSE GENERATOR FOR TESTING PURPOSES. H. Blumberg and H. Schreiber (Humboldt Universität, Berlin). Atompraxis 5, 314-15(1959). (In German)

A simple double-pulse generator, which can easily be built in any isotope laboratory and which makes it possible to determine the true resolving power of electronic pulse counters, is described. (auth)

2554

SIMPLE BETA COUNTER WITH SMALL ZERO EFFECT. W. Feldt. Atompraxis 5, 316-19(1959). (In German)

The size and form of the sensitive volume, as well as window thickness, strongly influence the sensitivity of counters in regard to low-energy radiation. In place of a normal end-window counter, a thin-window flow counter with a suitably formed sensitive volume is used. An improvement in the detection limit with the same detection volume can be obtained only by using an anticoincidence circuit, which considerably lowers the zero effect. The zero effect can also be lowered greatly by avoiding construction materials with residual activity. If sufficient test material is available, an even better counting yield can be obtained, in spite of a slight rise in zero effect, by enlarging the sensitive volume and simultaneously increasing the quantity of material. (auth)

2555

SIMULTAN-RADIOTEST—A DEVICE FOR THE MEASUREMENT AND RECORDING OF RADIOACTIVITY, ESPECIALLY IN CLINICAL RADIOISOTOPIC DIAGNOSIS. H. Hundeshagen, E. H. Graul, and G. Reckewell (Philips-Universität, Marburg, Ger.). Atompraxis 5, 357-8(1959). (In German)

A combination device which was developed in the Department of Radiobiology and Isotope Research at the University of Marburg is described. It consists of three counting systems, each of which has a scintillation detector armed with a Honeycone collimator. The impulses are recorded on tape, after which the most favorable curves are tested by repeated play-backs via an oscilloscope, and then are put on the permanent registration system. After injection of radioactive substances, this device makes it possible to carry out liver and kidney function tests and especially determinations of various circulatory factors in connection with electrocardiogram, pulse, heart-beat, and activity-distribution curves. (auth)

2556

GRAPHITE IONIZATION CHAMBER OF THE 4 π-γ TYPE. Jean-Jacques Engelmann. Compt. rend. 249, 1628-30 (1959) Oct. 28. (In French)

The 4-π chamber and the air-equivalence chamber are combined to obtain a high efficiency detector for gamma radiation which gives a response in roentgens independent of the gamma energy. The shape of the electrodes makes it possible to measure non-point radiation sources. The sensitivity of the chamber for radium is approximately 0.75×10^{-11} amp/mc, and the activity threshold measurable with the same precision is about 20 μc. (J.S.R.)

2557

RESULT OF THE DESIGN AND CONSTRUCTION OF A COMPENSATED IONIZATION CHAMBER FOR THE MONCLOA REACTOR. Manuel Quinteiro Blanco (Junta de Energia Nuclear, Madrid). Energia Nuclear (Madrid) 3, No. 11, 67-73(1959) July-Sept. (In Spanish)

The design and performance of an ionization chamber for neutron detection and measurement in the Moncloa reactor is described. The ionization chamber is of the parallel plate type. Each plate is coated with boron. The chamber is constructed of aluminum and is filled with argon at atmospheric pressure. The compensation system used is described. A comparison of the linear relationship of current and neutron flux was made between this ionization chamber and a commercial chamber. The results show that the chamber constructed for the Moncloa reactor has comparable performance. (J.S.R.)

2558

TRANSISTORIZED COLLINGE-HUXTABLE BINARY CIRCUIT. P. Principi and V. Svelto (Centro Informazione Studi Esperienze, Milan). Energia nucleare (Milan) 6, 635-6(1959) Oct.

A transistorized binary scaler is described using >7 Mc/sec cutoff transistors. A resolution power better than 100 ns is reached for couples of suitably shaped pulses. (auth)

2559

A 4 π-COUNTER FOR THE MEASUREMENT OF RADIOACTIVE ISOTOPES. G. Krueger. Expti. Tech. Physik 6, No. 3, 109-14(1958). (Translated from Referat. Zhur. Khim. No. 8, 1959, Abstract No. 27232)

A 4 π-methane counter designed for the measurement of the absolute rate of decomposition of radioactive isotopes is described. The counter consists of two measuring hemi-

spheres of 35 mm radius with counting loops of Mo wire. Each hemisphere represents a complete 2 π counter and can be operated independently if desired. The hemispheres are separated by a movable slide with an opening at the center which holds a removable ring used to support the thin foil with the compound to be analyzed. Purified CH_4 is passed slowly through the counter at atmospheric pressure to make possible a rapid change of samples without necessitating the evacuation of the air leaking into the apparatus, since the gas space remains practically sealed. The potential on the counter is 500 to 5000 v; the plateau in the 400 to 600 v range has a slope of about 1%. The use of an integral discriminator is recommended for the improvement of the above characteristics. Sources of possible errors are discussed.

2560

A HIGH-RESOLUTION SPECTROMETER FOR NUCLEAR MAGNETIC RESONANCE. H. J. Köhler, M. Pettig, and G. Scheler (Physikalisches Institut der Friedrich-Schiller-Universität, Jena, Ger.). Exptl. Tech. Physik. 7, 157-62 (1959). (In German)

A nuclear resonance spectrometer with a resolving power of 10^7 is described. The magnetic field is produced by means of a low-resistance electromagnet with 20-cm pole-face diameter. The measuring frequency of 30 MHz is obtained by multiplying a 100 kHz normal frequency. The required sample size is only a cubic millimeter. (tr-auth)

2561

A CIRCULATING PUMP MADE ENTIRELY OF GLASS. G. H. Oberem. Glas-Instr.-Tech. 2, No. 4, 13(1958). (Translated from Referat. Zhur. Khim. No. 8, 1959, Abstract No. 27276)

A centrifugal pump with a delivery of 8 liters/min at 2000 rpm and at a delivery and pressure of 1 meter water gage is described. The pump is intended for the pumping of corrosive and radioactive liquids.

2562

MAGNETIC DEVICES IN GLASS APPARATUS. PART II. G. Gamisch and W. Ruettiger. Glas-Instr.-Tech. 2, No. 5, 3-5(1958). (Translated from Referat. Zhur. Khim. No. 8, 1959, Abstract No. 27282)

The design of glass two-way and multiple position stoppers, funnels, and other distributors intended for the transfer of highly purified solutions from one vessel into a number of additional vessels and remotely controlled by means of electromagnets is described. The glass cylinder holds a distributor tube which can be turned at a specified angle so that its lower end connects to one of the delivery tubes of the cylinder. A permanent magnet is soldered to the tube at its upper end; this magnet can be activated by another permanent magnet or by an electromagnet. While the electromagnet is activated liquid will flow into the selected vessel. When the electromagnet is controlled by a pulse transducer, the position of the distributor tube can be varied in such a way that the flowing liquid is distributed over the various delivery tubes in predetermined quantitative ratios. The construction of apparatus for the controlled displacement of gas and vapor streams is described. The instruments can be used for the handling of toxic and radioactive substances and for the pumping of liquids under high vacuum.

2563

ABSOLUTE MEASUREMENT OF RADIOACTIVE SOURCE STRENGTHS WITH THE HELP OF A NEW DEVELOPMENT OF THE COINCIDENCE METHOD. K. P. Meyer, P. Schmid, and P. Huber (Universität, Basel). Helv. Phys. Acta 32, 423-44(1959). (In German)

The coincidence-method, a well known method for measuring absolute radioactive source-strengths (number of decays per second), has been confined in its application to a few special decay schemes. A new development of this method makes it now applicable to wide classes of disintegration schemes and all kinds of radiation. Using over-all counter responses (W) of less than 0.01 the new method constitutes the limiting case ($W \ll 1$), opposite to the 4π counter ($W \approx 1$). By making the counters roughly equally sensitive for both radiations, which are the partners of the coincidence, counter response and solid angle vanish quite generally from the expressions for the source-strength. Practical methods are given on how to realize equal response for both radiations with scintillation counters. A difference in response of 10% only makes an error of 0.3% in the value of the absolute source strength. Corrections are considered for source extension, angular correlation, and finite resolving power of the apparatus. Generally, the precision of the absolute values will be at least 1%, in favorable cases 0.2% are possible. Measurements with Na^{24}, Co^{60}, Na^{22}, and Au^{198} are given. (auth)

2564

IMPROVEMENTS TO A PHOTOELECTRIC DETECTION DEVICE FOR THE STUDY OF RAYLEIGH SCATTERING. A. Massoulier, J. Pardies, and F. Valentin. J. phys. radium 20, 47-50S(1959) Oct. (In French)

A photoelectric detection device was designed for the study of Rayleigh scattering. The device, as originally constructed, had relatively low sensitivity. In the first modification to improve the sensitivity the high-frequency voltage was applied to only one of the circuit dynodes instead of to the series of dynodes. The second modification resulted in the complete reconstruction of the apparatus with some slight changes and improvements in the amplifier, the photomultiplier feed, and the modulation oscillator. The major improvement to the device was the compensation of the residual voltage on the photomultiplier anode at 455 kHz. To compensate for the residual voltage a fraction of the oscillator voltage is reinserted, in phase opposition, at the base of the transformer of the photomultiplier anode. In the latest modification the sensitivity is limited only by the dark current of the photomultiplier. (J.S.R.)

2565

RESOLVING POWER AND EFFICIENCY OF A β SPECTROMETER WITH SPIRAL ORBITS. Adèle Burdet (Université, Lyon). J. phys. radium 20, 837-9(1959) Oct. (In French)

The resolving power and efficiency of a beta spectrometer based on the properties of the trajectories of charged particles in a magnetic field of revolution are considered. The general characteristics of the magnetic field of revolution are defined and the equations of motion and the trajectory form are derived. The resolving power of the spectrometer is then discussed. The results of the study are extended to a circular source. The efficiency of the spectrometer is 40% for a circular source with a diameter of 5/10 mm and 80% for a source 2/10 mm in diameter. The effect of the centering of the source is briefly considered. (J.S.R.)

2566

NEUTRON DIFFRACTION INSTRUMENTS AT A HIGH-FLUX NUCLEAR REACTOR. G. E. Bacon and R. F. Dyer

(Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr. 36, 419-21(1959) Oct.

A description is given of an assembly at a high-flux reactor of two instruments for neutron diffraction measurements. One is a large instrument for use with polycrystalline samples; the other, much smaller, is for single-crystal work. An account is included of the associated in-pile equipment and shielding for producing the collimated beams of thermal neutrons. (auth)

2567

PRECISION MICROPHOTOMETER FOR USE WITH A VICKERS PROJECTION MICROSCOPE. S. M. Makin and G. T. Rogers (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr. 36, 428-32(1959) Oct.

A microphotometer has been designed to measure photographic density and density gradients in autoradiographs. The equipment is designed to be used with a Vickers projection microscope, being particularly useful in the quantitative study of autoradiographs from metallurgical specimens. Results can be obtained over a magnification range of 18.6 to 400 times. The photographic density is measured by balancing the output of two photomultipliers, one in the incident beam and one in the transmitted beam. Densities measured on this instrument were compared with the quoted values on a standardized density wedge and gave a standard deviation of 0.006. (auth)

2568

CHARACTERISTICS OF SPARK COUNTERS. A. El-Nadi and F. M. Aly (Univ. of Cairo). J. Sci. Instr. 36, 434-6 (1959) Oct.

The spark counter, operating as an α-particle detector, has been studied extensively both with respect to the corona current in a given gas, and for different gases. The performance of a single wire counter was first studied, and then the experiments were extended to multiple wire counters. Nitrogen showed good characteristics with a single-wire counter, but failed for multiple wires, whereas dry air showed the best characteristics with a counter with six wires. (auth)

2569

DESIGN FOR AN AUTOGRAPHICALLY RECORDING TENSILE MACHINE. M. A. Adams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr. 36, 444-6(1959) Oct.

An improved "hard" type tensile machine is described, designed primarily for metallurgical usage. Compactness and mechanical simplicity are combined with maximum accessibility of the load measuring device and specimen, and the load is measured with an electro-mechanical dynamometer which is easily adapted into a system for autographically recording the load-elongation curve. The machine should be particularly useful for dry-box or hot-cell work. (auth)

2570

RADIOMETRIC METHODS. V. I. Baranov and T. V. Malysheva. Khim. Nauka i Prom. 4, 526-30(1959). (In Russian)

Radiometric methods, instruments, and techniques for measuring weak β radiation, calculating the absolute number of radioisotopes decaying in orbital electron capture, and identifying substances in complex radioisotopic mixtures are reviewed. (R.V.J.)

2571

THE IONIC PUMP. B. S. Danilin. Nauka i Zhizn No. 6, 67(1959).

A description of modern vacuum-producing pumps such as the ionic pump and the ionic-evaporative pump is given. Special attention is drawn to the ionic-evaporative pump working with titanium. As deep as 10^{-9} mm of mercury column vacuum can be reached with such a pump, and its performance is 10,000 l/sec. Such a deep vacuum is said to be needed in a series of technical processes, including thermonuclear ones. (TCO)

2572

A TRANSISTOR CIRCUIT FOR FAST COINCIDENCE MEASUREMENTS. G. B. B. Chaplin and C. J. N. Candy (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Instr. and Methods 5, 242-6(1959) Oct.

A coincidence circuit is described which has a short resolving time (< 5 mμsec), and a high rejection of non-coincident pulses; coincident one volt pulses trigger the circuit while single 40 v pulses do not. Use is made of germanium diodes and transistors, and pulse shaping is accomplished by means of small inductances. The resulting circuit is sensitive, compact, and consumes little power. (auth)

2573

A HIGH ENERGY GAMMA RAY SPECTROMETER. R. Gabriel, E. L. Garwin, and C. M. York (Enrico Fermi Inst. for Nuclear Studies, Chicago and Univ. of Chicago). Nuclear Instr. and Methods 5, 247-53 (1959) Oct.

A gamma-ray spectrometer for use in the energy range 50 to 150 Mev is described. The spectrometer employs a rather conventional lead glass Cherenkov counter in coincidence with a scintillation-counter telescope as a detector. The circuits which detect and analyze the gamma rays are of simple and reliable design, and use only crystal diodes and switching transistors as their active elements. The results of a calibration experiment using an electron beam are presented to demonstrate the performance of the apparatus. (auth)

2574

A MODIFICATION OF THE NUCLEAR RESONANCE METHOD FOR MEASUREMENTS OF NON-UNIFORM MAGNETIC FIELDS. C. H. Vincent, W. G. King, and J. B. Rowles (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nuclear Instr. and Methods 5, 254-8(1959) Oct.

It is practicable to obtain accurate measurements of magnetic field intensity in non-uniform fields by the nuclear resonance method with the aid of a set of current-carrying coils which neutralize the field gradient. For use on an electromagnet, a method of controlling the compensating currents by reference to the magnet current is described. This method simplifies the adjustment of the compensating currents. Field gradients up to 150 gauss/cm may be neutralized by the equipment described, which was used in fields ranging from 2 to 10 k/G. In the instruments constructed, it was only necessary to compensate for variations of the field along the two axes normal to the field itself. However, it should be possible to compensate for variation along the axis parallel to the field as well, without difficulty, and the coil arrangement required for this is described also. (auth)

2575

INSTRUMENT DEVELOPMENT AT SAVANNAH RIVER. II. REACTOR, PROCESS INSTRUMENTS. J. N. Wilson (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucleonics 17, No. 11, 140; 142; 144-6; 148(1959) Nov.

A review is given of instrumentation for nondestructive testing of reactor fuel and for chemical separation of irradiated fuel. The application of several "in-line" analytical instruments such as the turbidimeter, gamma absorptometer, conductivity cells, colorimeter, and a gamma monitor are discussed. (C.J.G.)

2576

LARGE-CRYSTAL COUNTING. M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). Nucleonics 17, No. 11, 150, 152, 155(1959) Nov.

The design of a large NaI(Tl) scintillation spectrometer (crystal diameter of 4 to 9 in. and a few inches thick) is discussed. Factors of resolution stability, background, and mechanical design which affect the choice of photomultiplier for viewing the crystal are discussed. (C.J.G.)

2577

FLUORESCENT RESPONSE OF CESIUM IODIDE CRYSTALS TO HEAVY IONS. A. R. Quinton, C. E. Anderson, and W. J Knox (Yale Univ., New Haven). Phys Rev. 115, 886-7(1959) Aug. 15.

The light output from thallium-activated cesium iodide crystals was determined using C^{12}, N^{14}, and O^{16} as incident particles, with energies up to 10 Mev per nucleon. A photocathode with S-11 response viewed the scintillator light and the photomultiplier pulses were compared with those produced by alpha particles and protons of known energies. This is evidence that low-energy heavy ions are inefficient producers of light in this spectral region. (auth)

2578

INTEGRATOR FOR THE RECORDING IN LOGARITHMIC SCALE THE DISINTEGRATION CURVES OF RADIOACTIVE SUBSTANCES. Kurt Franz (Comisión Nacional de la Energía Atómica Buenos Aires). Publs. com. nacl. energía atómica (Buenos Aires) Ser. Fis. 1, 101-14(1955). (In Spanish)

A count rate meter with logarithmic scale recording designed for the study of the decay curves in radioactive materials, is described. The results obtained for the isotopes Ag^{110}, V^{52}, Rh^{104m}, and In^{116m} are given. The basic circuits used in the rate meter are graphed and discussed. The circuits of the potentiometer used are also given. The rate meter has a precision of more than 1%. (J.S.R.)

2579

RADIATION DOSIMETRY WITH FLUORODS. Miniature Glass Rod Dosimetry. Morris Hodara and Milton Friedman (Hospital for Joint Diseases, New York) and Gerald J. Hine (Veterans Administration Hospital, Boston). Radiology 73, 693-706(1959) Nov.

The fluorod (a silver-activated phosphate glass rod) is a tiny dosimeter whose fluorescence following ionizing irradiation is proportional to the dose. Its potential usefulness in clinical radiation therapy, due to its small size (1 × 6 mm), prompted a physical and clinical investigation of its dosimetric properties. Following exposure to radiation, the fluorod is positioned in a fluorimeter and its fluorescence under ultraviolet light is measured. The fluorod has the following dosimetric properties when exposed to 2-Mvp x rays; the response is linear to dose up to at least 8,000 r; it is independent of temperature at the time of exposure; it is independent of the direction of the incident beam of radiation in a scattering material; the fluorescence fades very slowly over a period of many months; the background fluorescence is approximately 80 to 100 r, making the fluorod useful for experimental or clinical doses above 200 r; heat treatment for approximately five hours at 400°C reduces the dose effect to background level so that the fluorod can be used again. Because of energy dependence, fluorods should be used only for energies higher than 400-kvp x rays. They are particularly useful for supervoltage x rays and radium and Co^{60} gamma-ray dose measurements. The dose responses to radioisotope beta rays in solution and high-energy betatron electron beams were determined. Pilot dosimetry in phantoms and patients showed potential clinical usefulness of the fluorod. Problems such as tangential beam dosimetry, measurements of tumor dosage in body cavities, and dose measurements close to Co^{60} topical applicators were studied in particular. (auth)

2580

DETERMINATION OF ABSOLUTE NEUTRON FLUX BY GOLD ACTIVATION. J. F. Raffle (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 10, 8-13(1959) July.

A technique is described for determining the neutron flux in a beam to better than 1% from an absolute measurement of the activity induced in gold foils by neutron capture. The construction of special gridded ionization chambers with B^{10} layers and their calibration in terms of the gold cross section to form secondary standards is described. (auth)

2581

MOLECULAR PUMPING. J. W. Beams (Univ. of Virginia, Charlottesville). Science 130, 1406-7(1959) Nov. 20.

A method is described for producing high vacua. A magnetically suspended molecular pumping rotor is operated inside a sealed glass vacuum system. The system is free of lubricants and can be baked out. The system gives promise of producing pressures below those previously used. (auth)

2582

POSSIBILITIES OF ERRORS IN MEASUREMENT IN THE VERIFICATION OF THE ROENTGEN UNIT WITH FREE-AIR-IONIZATION CHAMBERS. Erich Bunde, Andreas Sewkor, and Dimitri Lang (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 110, 248-59(1959). (In German)

The accurate determination of the measuring volume is one of the most important conditions for the verification of the roentgen dose unit by means of a standard ionization chamber. The realization of this demand was discussed in detail and the importance of several controls of the size of the diaphragm cross section and the lenght of the electrode was pointed out, based on experiments made by the authors. It is possible that the beam used for the measurements is not homogeneous enough, making the results dependent on the size of the diaphragm and causing wrong results, when secondary standards or dosemeters are calibrated. This is particularly true if there are needed high dose rates with short focus distances. The authors' experiments also point out the importance of the diaphragm close to the focus. It was concluded that a standard chamber must be equipped with diaphragms of different sizes of cross section and particularly chambers for the determination of soft radiation doses should also be equipped with electrodes of different lengths, both being easily interchangeable without changing the position of the chamber. (auth)

2583

TRANSISTORIZED SINGLE-CHANNEL AMPLITUDE ANALYZER WITH AUTOMATIC SCANNING. Vladimiro Mandl and Luciano Stanchi (Centro Nazionale Richerche Nucleari, Ispra, Italy). Strumentazione e automazione No. 3, 124-6 (1959) Mar. (In Italian)

An analyzer is described which presents nuclear spectra

with scintillation counters in a completely automatic manner. There are 100 channels which are searched in succession and the spectrum is presented on a galvanometric register with a pen. The analyzer is equipped with a non-overloading amplifier, two discriminators, and one anti-coincidence circuit. The power is 10 v with 100 channels at a constant width of 0.1 v. The control of the channels is accomplished by means of a selector and a relay, and the measurement can be stopped or started in any channel of ten. The pulses are counted by means of a counting scaler and converted to current values which pass to the register. (tr-auth)

2584

AN ANTICOINCIDENCE CIRCUIT WITH TRANSISTORIZED BLOCKING OSCILLATORS. Luciano Stanchi (Centro Nazionale Richerche Nucleari, Ispra, Italy). Strumentazione e automazione No. 4, 183-5(1959) Apr. (In Italian)

Two transistorized blocking oscillators having transformers wound on ferrite cores are controlled by derived pulses coming from two discriminators. A third blocking oscillator is controlled by the front of the slope of the first oscillator, while the second oscillator furnishes the inhibitor pulse. The duration is proportional to the rise time of the incoming pulse in the discriminator. This arrangement permits reduction of dead-time to a minimum. (tr-auth)

2585

PERSONNEL RADIOACTIVITY MONITOR. Vladimiro Mandl (Centro Nazionale Richerche Nucleari, Ispra, 11-3-59pm Italy). Strumentazione e automazione No. 5, 225-7 (1959) May. (In Italian)

An apparatus is described which measures radioactive contamination on hands, shoes, and clothes. It consists of two photomultipliers with ZnS screens for alpha contamination of the hands, six Geiger counters to detect beta radiation from the shoes, and one probe for monitoring the clothes. The instrument is completely transistorized and automatic. Each measurement lasts 10 seconds and the results are indicated on two instruments. Dangerous contamination is signaled by acoustic and luminous alarms. (tr-auth)

2586

A TRANSISTOR AND MAGNETIC CORE DECIMAL SCALER. Guglielmo Giannelli (Centro Nazionale di Ricerche Nucleari, Ispra, Italy). Strumentazione e automazione No. 6, 279-80(1959) June. (In Italian)

A transistor blocking oscillator with saturated magnetic core is adapted to produce pulses of constant voltage-time area. Those pulses drive a square hysteresis loop inductor. The drive circuit is closed through the saturated transistor of a flip-flop whose position determines the direction in which the pulses act on the square loop core. Every five pulses saturate the core. The saturation current causes the commutation of the flip-flop and the reversal of the action of the drive pulse on the square loop core. (auth)

2587

A MASS SPECTROMETER FOR HIGH-VACUUM TECHNIQUES. Werner Tretner (Fernseh GmbH, Darmstadt, Ger.). Z. angew. Phys. 11, 395-9(1959) Oct. (In German)

A new kind of tube for mass analysis in an electric field according to the time-of-flight principle is reported. For one arrangement described, the resolving power $m/\Delta m$ amounts to about 20. In the pressure range above 10^{-8} Torr the mass spectrum can be oscillographically projected on the cycle of the system frequency. At pressures below 10^{-8} Torr the spectrum must be recorded slower or the signal current be amplified in a secondary-electron multiplier. The upper limit of measurement lies near 5×10^{-5} Torr. (tr-auth)

2588

STABILITY OF PHOTOELECTRIC MAGNET CURRENT REGULATORS. Karl Weinhardt (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. angew. Phys. 11, 403-7(1959) Oct. (In German)

The frequency characteristics and stability dependence of photoelectric magnet current regulators given in a form which permits discussion of the influence of the so-called integral or difference term on the stability in a simpler and clearer manner. The theoretical deliberation can be experimentally verified. For short time intervals a control accuracy of 10^{-4} was attained, and for several hours, 10^{-3}. (tr-auth)

2589

DISCHARGE PROPAGATION IN TRIGGERED COUNTING TUBES. K. H. Lauterjung and O. Vater (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 14a, 805-9(1959) Sept. (In German)

In argon–methylal filled triggered counting tubes the counting-tube discharge is propagated both by photoionization in the gas-vapor mixture as well as by the photo effect in the counting tube cathode. Propagation by photoionization in the filler-gas is over balanced by ordinary counting-tube overvoltages. At higher overvoltages and with increasing counting-tube age, and also with unfavorable operating conditions, propagation by the photo effect in the counting tube cathode increases with increasing mass. (tr-auth)

2590

STIGMATIC DISTORTION-FREE IMAGE-FORMING MASS SPECTROMETER. H. Liebl and H. Ewald (Technische Hochschule, Munich). Z. Naturforsch. 14a, 842-3(1959) Sept. (In German)

The case is considered of a stigmatic image-forming mass spectrometer with second-order double focusing, and which utilizes a toroid condenser and a homogeneous magnetic field. (T.R.H.)

2591

ATOMIC SPECTROGRAPH WITH HIGHER LIGHT INTENSITY, DISPERSION, AND RESOLUTION. H. Liebl (Technische Hochschule, Munich). Z. Naturforsch. 14a, 843-4 (1959) Sept. (In German)

The ion-optical representation by electric toroid field or by radial inhomogeneous magnetic field is considered. (T.R.H.)

2592

DOUBLE-FOCUSING DISTORTION-FREE MASS SPECTROMETER WITH ESPECIALLY HIGH RESOLUTION AND DISPERSION. H. Wachsmuth, H. Liebl, and H. Ewald (Technische Hochschule, Munich). Z. Naturforsch. 14a, 844-6(1959). (In German)

A further improvement of the performance of a mass spectrometer is discussed. (T.R.H.)

2593

UNILATERAL GROUNDING OF DEFLECTION CONDENSERS IN MASS SPECTROGRAPHS. H. Liebl and W. Wachsmuth (Technische Hochschule, Munich). Z. Naturforsch. 14a, 846-7(1959) Sept. (In German)

It is frequently necessary to ground the deflection condenser of mass spectrometers or spectrographs, especially when a power-supply is used for generation of the deflection potential. Some facts related to this arrangement are presented and discussed. (T.R.H.)

2594

MULTICASCADE ELECTROSTATIC ENERGY ANALYZER WITH INTEGRATED SPATIAL FOCUSING IN TWO PLANES. M. M. Bredov. Zhur. Tekh. Fiz. 29, 1032-8 (1959) Aug. (In Russian)

Descriptions are given of an electrostatic energy analyzer, with electrostatic mirror reflections formed by hyperbolic cylindrical electrodes, by means of which an integrated angular focusing is achieved with second order precision in the plane of field symmetry and first order precision in the cross section plane. The multicascade apparatus with multiple reflection permits an extensive variation of the longitudinal and cross section dimensions at fixed dispersion. (tr-auth)

2595

IMPROVEMENTS IN OR RELATING TO NUCLEAR PARTICLE DISCRIMINATORS. Francis Dey Brooks (to United Kingdom Atomic Energy Authority). British Patent 823,263. Nov. 11, 1959.

A particle discriminator is described which involves the use of two electrodes in a photomultiplier to produce two pulses for one scintillation. One pulse is amplitude-dependent, the other is amplitude- and duration-dependent. The difference pulse derived from them is submitted to an amplitude discriminator for selection. The pulse generation can be accomplished by a semiconductor and capacitor in a pulse stretching circuit, or by a shorted delay line for clipping one pulse. The derived pulse is produced in a pulse integrator. (T.R.H.)

2596

TIMING CIRCUIT. J. W. Heyd (to U. S. Atomic Energy Commission). U. S. Patent 2,895,047. July 14, 1959.

An electronic circuit is described for precisely controlling the power delivered to a load from an a-c source, and is particularly useful as a welder timer. The power is delivered in uniform pulses, produced by a thyratron, the number of pulses being controlled by a one-shot multivibrator. The starting pulse is synchronized with the a-c line frequency so that each multivibrator cycle begins at about the same point in the a-c cycle.

2597

APPARATUS FOR MEASURING NEUTRON CROSS SECTIONS. L. Cranberg (to U. S. Atomic Energy Commission). U. S. Patent 2,895,051. July 14, 1959.

An apparatus is described for analyzing the nuclear reaction products resulting from impingement of nuclear particles against a selected target material and automatically recording the number of reaction products in selected energy levels. The target is bombarded by ions from a particle accelerator and the target potential is cyclicly varied over a particular energy range by a modulator. A nuclear reaction detector is located adjacent the target to produce pulses for each reaction product. The output from the detector and the modulator are coupled to a function sampler, for generating a pulse in response to each detected event having an amplitude proportional to the amplitude of the instantaneous target potential. The later pulses are coupled to a multichannel analyzer, whereby nuclear reactions are recorded in appropriate channels of the analyzer in correspondence with the magnitude of the energy of the impinging ions.

2598

MEASURING PROJECTOR. J. V. Franck, P. S. Broadhead, and E. W. Skiff (to U. S. Atomic Energy Commission). U. S. Patent 2,895,053. July 14, 1959.

A semiautomatic measuring projector particularly adapted for measurement of the coordinates of photographic images of particle tracks as produced in a bubble or cloud chamber is presented. A viewing screen aids the operator in selecting a particle track for measurement. After approximate manual alignment, an image scanning system coupled to a servo control provides automatic exact alignment of a track image with a reference point. The apparatus can follow along a track with a continuous motion while recording coordinate data at various selected points along the track. The coordinate data is recorded on punched cards for subsequent computer calculation of particle trajectory, momentum, etc.

2599

METHOD AND APPARATUS FOR DETERMINING CHARGED PARTICLE MOTION. Q. A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 2,897,605. Aug. 4, 1959.

An analog system for determining the motion of charged particles in three dimensional electrical fields is described. A model electrode structure is formed and potentials are applied to the electrodes to provide an analog of the field which is to be studied. To simulate charged particles within the model, conducting spheres are placed at points from which particle motion is to be traced. To free the spheres from gravitational attraction in order that they will be electrostatically accelerated through the model, the apparatus is suspended and dropped. During the period that the model is dropping the spheres move through the electrode structure with a motion corresponding to that of particles in the real system. The model is photographed in the course of falling so that the instantaneous position of the spheres within the simulated field at selected times may be observed and measured. The device thus gives data which frequently can otherwise be obtained only with a digital computer.

2600

DIMENSION MEASURING OPTICAL SIGHTING DEVICE. G. E. Kerr (to U. S. Atomic Energy Commission). U. S. Patent 2,897,718. Aug. 4, 1959.

A sighting device to check the uniformity of thickness of a lining applied to a container is presented. The sighting device comprises two tubular members having their ends in threaded connection with one another and a lens lying within the outer end of one of the tubular members. A ground glass inscribed with two concentric circles is located at the outer end of the other tubular section so that the image of the circular junctures, with and without the lining at the closed end of the container, can be focused on the proper circle inscribed in the ground glass so as to determine whether the lining has uniformity and whether there are thin spots.

2601

AIRBORNE RADIATION DETECTOR. T. R. Cartmell and J. F. Gifford (to U. S. Atomic Energy Commission). U. S. Patent 2,898,497. Aug. 4, 1959.

An ionization chamber used for measuring the radioactivity of dust present in atmospheric air is described. More particularly, the patent describes a device comprising two concentric open ended, electrically connected cylinders between which is disposed a wire electrode. A heating source is disposed inside of the cylinder to circulate air through the space between the two cylinders by convective flow. A high voltage electric field between the wire electrode of the electrically connected cylinder will cause ionization of the air as it passes therethrough.

2602

RESONANT CAVITY EXCITATION SYSTEM. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,898,555. Aug. 4, 1959.

A cavity excitation circuit is described for rapidly building up and maintaining high-level oscillations in a resonant cavity. The circuit overcomes oscillation buildup slowing effects such as ion locking in the cavity by providing for the selective application of an amplified accelerating drive signal to the main cavity exciting oscillator during oscillation buildup and a direct drive signal to the oscillator thereafter.

2603

APPARATUS FOR PRODUCING SHADOWGRAPHS. R. R. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,899,557. Aug. 11, 1959.

An apparatus is presented for obtaining shadowgraphs or radiographs of an object exposed to x rays or the like. The device includes the combination of a cloud chamber having the interior illuminated and a portion thereof transparent to light rays and x rays, a controlled source of x rays spaced therefrom, photographic recording disposed laterally of the linear path intermediate the source and the chamber portion in oblique angularity in aspect to the path. The object to be studied is disposed intermediate the x-ray source and chamber in the linear path to provide an x-ray transmission barrier therebetween. The shadowgraph is produced in the cloud chamber in response to initiation of the x-ray source and recorded photographically.

Materials Testing

2604 AECU-4481

Southwest Research Inst., San Antonio.

CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 12. M. M. Lemcoe. Oct. 15, 1959. 83p. Project No. 773-2. Contract AT(30-1)-2140. OTS.

Strain measurements under static conditions of internal pressures up to 2200 psig were completed. A summary of the data obtained was prepared which will permit comparison of stress concentrations around the various nozzle designs incorporated in the test vessel. Drawings of the test vessels, the nozzle configurations, and strain gage locations are included. Test results are presented in tabular form as principal stresses computed from strain gage rosette measurements. Plots of these stresses at the rosette locations on the surfaces of the vessel are presented. (auth)

2605 DP-408

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

A CLADDING THICKNESS TESTER FOR ZIRCONIUM OVER URANIUM. Arthur P. Holt. Sept. 1959. 12p. Contract AT(07-2)-1. OTS.

An instrument is described that can be used to measure the thickness of zirconium cladding on a metallic uranium base. The instrument operates on the eddy current principle. The sensing element is a hand-held probe. Cladding thickness changes of $\frac{1}{4}$ mil can be detected in the range of 5 to 25 mils thickness. The sensitivity of the instrument is only slightly affected by temperature changes and input power variations. (auth)

2606 NAA-SR-Memo-3919

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TESTS OF FUME SCRUBBERS TO REDUCE ORGANIC VAPOR CONCENTRATION. A. N. Gallegos. May 27, 1959. 10p. OTS.

Three commercially available fume scrubbers were tested to determine their efficiency in removing organic vapor from mixtures of Santowax-R and steam, using water as the condensing and scrubbing agent. The test conditions studied included mixtures of steam and Santowax-R at a pressure of 300 psig and a temperature of 600°F. Results are included. (W.L.H.)

2607 NYO-2328

Southwest Research Inst., San Antonio.

FATIGUE DAMAGE IN MATERIALS EMPLOYED IN PRESSURE EQUIPMENT. Progress Report No. 3 for July 1, 1959 through October 31, 1959. L. U. Rastrelli. Nov, 1, 1959. 77p. Contract AT(30-1)-2146. OTS.

Preliminary results of a study related to phenomenological aspects of cumulative damage theories and their significance in pressure vessel fatigue analysis are presented as a compilation of equations. Basic damage equations are examined and parameters of these equations are defined. The significance of load spectrums are discussed, and solutions are presented for damage equations to be used in relation to design parameters. (For preceding period see NYO-2323.) (J.R.D.)

2608 SCTM-217-54(51)

Sandia Corp., Albuquerque, N. Mex.

COMPARISON OF THE ROOT CURVATURE OF A UNIFORM CANTILEVER BEAM UNDER DYNAMIC LOADS WITH THE ROOT CURVATURE UNDER A STATIC LOAD PRODUCING THE SAME TIP DEFLECTION. Millard V. Barton and Charles W. McLarnan. Oct. 6, 1954. Changed from OFFICIAL USE ONLY Oct. 27, 1959. 15p. OTS.

The inaccuracies introduced by using the static deflection curve as the dynamic deflection curve and measuring the response of a uniform beam in terms of tip deflection are studied. The mentioned inaccuracies are assessed on the assumption that root curvature (i.e., stress or strain) rather than tip deflection is the correct measure of the beam's response. (auth)

2609

NON DESTRUCTIVE TESTING OF SOLID FUEL ELEMENTS. G. Perona (Centro Informazione Studi Esperienze, Milan). Energia nucleare (Milan) 6, 621-7 (1959) Oct. (In Italian)

Testing of fuel elements and their components during consecutive working steps and after their finishing is described. Some of the methods employed have been purposely set up, other have been conveniently modified compared with these traditionally used for non-destructive testing of ordinary machined pieces. All these methods are briefly described. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

2610

AN X-RAY STUDY OF UMOHOITE. Samuel R. Kamhi (Columbia Univ., New York). Am. Mineralogist 44, 920-5 (1959) Sept.-Oct.

Procession photographs of umohoite from Marysvale, Utah, indicate a primitive orthorhombic unit cell with dimensions $a_0 = 6.32$ A; $b_0 = 7.48$ A; $c_0 = 12.4$ and 14.5 to 17.0 A. The range of c_0 with humidity and with temperature is established. X-ray powder data for umohoite with $c_0 = 12.4$ A are listed, and indices have been assigned on the basis of the cell dimensions given. Powder data are also furnished for material with $c_0 = 14.5$ A. (auth)

2611

AN X-RAY CRYSTALLOGRAPHIC STUDY OF SCHROECKINGERITE AND ITS DEHYDRATION PRODUCT. Deane K. Smith (National Bureau of Standards, Washington, D. C.). Am. Mineralogist 44, 1020-5(1959) Sept.-Oct.

X-ray precession patterns of schroeckingerite crystals from Moab, Utah, show that the mineral has triclinic pseudo-hexagonal symmetry. Dimensions of the unit cell containing $2(NaCa_3UO_2(CO_3)_3SO_4F \cdot 10H_2O)$ are a = 9.60 ± 0.01 A, b = 9.62 ± 0.01 A, c = 14.46 ± 0.01 A, α = 91°42′ ± 10′, β = 91°48′ ± 10′, and γ = 120°05′ ± 10′. The space group is $P\bar{1}$ or P1. When the material is dried at 75°C, it loses six of the ten water molecules. The unit cell of the product has a = b = 9.52 ± 0.02 A, c = 11.10 ± 0.02 A, α = 95 ± 5°, β = 93 ± 5° and γ = 60°00′ ± 15′, and its space group is also $P\bar{1}$ or P1 with Z = 2. (auth)

2612

NEW DATA ON GASTUNITE, AN ALKALI URANYL SILICATE. Russell M. Honea (Univ. of Colorado, Boulder). Am. Mineralogist 44, 1047-56(1959) Sept.-Oct.

Gastunite is an alkali uranyl silicate with the composition $(K, Na)_2(UO_2)_3(Si_2O_5)_4 \cdot 8H_2O$. Chemical analysis, recalculated after deducting impurities, gives SiO_2—31.2, UO_3—53.8, K_2O—4.6, Na_2O—0.9, H_2O—9.5, total 100.0%. The proposed formula is supported by infrared absorption data. X-ray study shows the mineral to be orthorhombic, space group Pnna, a_0—14.24, b_0—35.84, c_0—14.20, calculated specific gravity 3.97 (3.96 ± 0.03 measured). Indexed powder pattern shows the strongest lines to be 7.12 (10), 3.56 (9), 9.10 (8), 4.83 (7), and 3.31 (7). Optically biaxial positive with α = 1.604, β = 1.610, γ = 1.621: 2V moderate, anomalous blue interference color. Habit: radiating acicular to fibrous aggregates. Hardness 2. Perfect (010) cleavage. Gastunite occurs as a secondary mineral in radial aggregates coating chalcedony at the Red Knob mine, Muggins Mountains, Yuma County, Arizona; and in vesicular cavities in welded tuff at the Mammoth prospect, Presidio County, Texas. Also present in dense fine-grained pseudomorphs after uraninite from the Easton area, Pennsylvania. Hydrothermal synthesis data for the potassium, potassium plus sodium, sodium, ammonium, and hydronium analogs of gastunite are presented. (auth)

2613

THE PREPARATION AND PROPERTIES OF URANIUM (IV) SILICATE. L. H. Fuchs and H. R. Hoekstra (Argonne National Lab., Lemont, Ill.). Am. Mineralogist 44, 1057-63 (1959) Sept.-Oct.

Uranium(IV) orthosilicate, corresponding to the mineral coffinite, has been synthesized by a hydrothermal procedure. Preparative conditions including precipitation techniques, temperature, pH, and uranium oxidation state have been investigated. $USiO_4$ is a blue microcrystalline compound isostructural with thorite and zircon. The infrared spectrum of $USiO_4$ shows an absorption maximum at 11.1 μ, characteristic of isolated SiO_4^{4-}tetrahedra. No evidence was found for hydroxyl substitution in the synthetic material. $USiO_4$ is stable to 1000°C in a vacuum and to 500°C in air. (auth)

2614

UNUSUAL GALENA FROM THE BOULDER BATHOLITH, MONTANA. William P. Shulhof (General Motors Corp., Flint, Mich.) and Harold D. Wright (Pennsylvania State Univ., University Park). Am. Mineralogist 44, 1096-8 (1959) Sept.-Oct.

A brief study was made of the occurrence of a galena mineral associated with uraninite, which it resembles both in shape and in their isolated occurrence in microcrystalline quartz. (J.E.D.)

2615

LEAD ISOTOPES IN MANGANESE NODULES. Tsaihwa J. Chow and C. C. Patterson (California Inst. of Tech., Pasadena). Geochim. et Cosmochim. Acta 17, 21-31(1959) Aug.

The isotopic compositions of leads which were isolated from manganese nodules of the Atlantic and the Pacific Oceans were determined. The Atlantic leads were more radiogenic than those of the Pacific. The Pacific samples showed a trend of increasing radiogenic leads from the north-west toward the south-east Pacific. The relationship between the collecting sites and the isotopic compositions of leads can be used to trace the circulation patterns of deep-water masses. The oceanic leads originated from rock systems whose uranium and lead contents have differentiated at various times appreciably later than 4.5×10^9 years. (auth)

2616

THE COSMOGENIC He^3 AND He^4 DISTRIBUTION IN THE METEORITE CARBO. J. H. Hoffman and A. O. Nier (Univ. of Minnesota, Minneapolis). Geochim. et Cosmochim. Acta 17, 32-6(1959) Aug.

The cosmogenic He^3 and He^4 distribution in a cross section of the iron meteorite, Carbo, has been made with a mass spectrometer. The He^3/He^4 ratio is approximately constant throughout most of the cross section and has a value of 0.239. The amount of He^3 varies between the approximate limits of 3.2 and 4.6×10^{-6} std cm^3/g of meteorite. Contours of constant He^3 and He^4 were plotted. These are open curves indicating the meteorite was either split in half late in its lifetime or eroded away on one side since its fall to earth. (auth)

2617

MEASUREMENT OF B^{10} CONTENT OF MINERALS. G. Allais and H. Curien (Laboratoire de Minéralogie-Cristallographie, Paris). Geochim. et Cosmochim. Acta 17, 108-12(1959) Aug. (In French)

A method for analysis of B^{10} by thermal neutron absorption is given. The precision of the method is 2% and it is simple and rapid. The B^{10}/B^{11} ratio in five minerals of diverse origins was identified. (J.E.D.)

2618

BISMUTH, THALLIUM AND MERCURY IN STONE METEORITES BY ACTIVATION ANALYSIS. W. D. Ehmann and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Geochim. et Cosmochim. Acta 17, 125-35(1959) Aug.

The radiochemical procedures for the assay of bismuth, thallium, and mercury in stone meteorites following neutron activation are described in detail. A Bi^{209} abundance of 2.2×10^{-9} gram/gram meteorite leading to a cosmic abundance of 0.0016 (per 10^6 Si atoms) was determined from the analysis of six stone meteorites. A Tl^{203} abundance of 0.40×10^{-9} g/g meteorite and a Hg^{202} abundance of 30×10^{-9} g/g meteorite corresponding to cosmic abundances of 0.00030 and 0.023 (per 10^6 Si atoms), respectively, were determined from analysis of five stone meteorites. Implications of these data as pertaining to the life history of meteorites are discussed. (auth)

2619

COSMOGENIC POTASSIUM-40 IN IRON METEORITES. Masatake Honda (Univ. of California, La Jolla). Geochim. et Cosmochim. Acta 17, 148-50(1959) Aug.

The radioactivity of potassium isolated from samples of iron meteorite was measured using a low-level beta counter. (J.E.D.)

2620

ON THE PROSPECTING FOR THE "NINGYŌ-TŌGE" (SEDIMENTARY)-TYPE URANIUM DEPOSITS. I. PROBLEMS OF BASEMENT GRANITE. II. PROBLEMS CONCERNING SEDIMENTARY STRUCTURE AND STRUCTURAL CONTROL. M. Satō (Atomic Fuel Corp., [Tokyo]). J. Atomic Energy Soc. Japan 1, 9-18(1959) June. (In Japanese)

The present state of uranium prospecting in Japan indicates that the Ningyō-tōge uranium deposit of sedimentary type is much more promising as Japanese uranium resource than vein-type deposits. A method for effective and efficient prospecting for the Ningyō-tōge type uranium deposit is proposed. The method consists of picking out the granite districts containing comparatively higher contents of leachable uranium, finding the younger sediment in old closed basin, even if the contents of leachable uranium is poor, and examining the structure of the sediment to catch the high grade ore deposit by the phenomena of "uranium ore control". (auth)

2621

SOME EXPERIMENTS IN POTASSIUM-ARGON DATING. Minoru Ozima (Univ. of Toronto). J. Geophys. Research 64, 2033-4(1959) Nov.

The crushed mineral to be analyzed is placed in an alundum crucible with half of the mass calcium chloride. Under a vacuum the argon tracer is released to the system after which the system is heated to 1350°C. During heating the potassium in the mineral reacts with the calcium chloride to form potassium chloride which condenses on the walls of the crucible. Subsequent analysis of the solution with a flame photometer gives the potassium content of the sample. Argon was collected during the heating and purified for the argon determination. (C.J.G.)

2622

RADIOACTIVE ISOTOPES IN EARTH CRUST. A. K. Lavrukhina. Khim. Nauka i Prom. 4, 472-8(1959). (In Russian)

A survey is given of nuclear processes in the earth's crust and the distribution of radioactive elements. The importance of the decay of natural radioactive isotopes and of certain reactions in the evolution of chemical elements in the earth's crust is discussed. 101 references. (R.V.J.)

2623

RADIOISOTOPES IN THE DATING OF GEOLOGICAL AND ARCHAEOLOGICAL EVENTS. B. J. Giletti and R. St. J. Lambert (University Museum, Oxford). Research (London) 12, 368-73(1959) Oct.-Nov.

Methods for determining the age of geological and archaeological events by the use of radioisotopes are reviewed. The C^{14} method is described together with its application to events up to 70,000 years old. The U–Th–Pb, K^{40}–A^{40}, and Rb^{87}–Sr^{87} decay schemes are discussed in terms of their application to dating geological events which may be millions or even thousands of millions of years old. (auth)

2624

EQUATION OF CONTINUITY IN GEOLOGY WITH APPLICATIONS TO THE TRANSPORT OF RADIOACTIVE GAS. A. Y. Sakakura, Carolyn Lindberg, and Henry Faul. U. S. Geol. Survey Bull. 1052-I. 1959. 22p. $0.15(GPO).

The transport of matter by fluids percolating through a porous medium is described by setting up a mass-conservation equation, analogous to that of hydrodynamics, for each of the substances in question. The sources and sinks of these equations serve to take into account the contribution from the medium and the interactions with other transported substances. The transport of radon by natural gases is treated in detail for the case of two important sources: the extended source and the cylindrical-shell source. From the solutions of the steady-state cases, the two source types can be distinguished, provided source density is uniform. From the solution of the transient case, the boundary of the source nearest to the gas well can be established. The results are applied to some selected data from the Texas Panhandle gas field. (auth)

2625

STRATIGRAPHY OF THE AREA BETWEEN HERNANDO AND HARDEE COUNTIES, FLORIDA. Keith B. Ketner and Lawrence J. McGreevy. U. S. Geol. Survey Bull. 1074-C. 1959. 79p., 3 illus. $0.75(GPO).

Eocene, Oligocene, Miocene, and Recent rocks are exposed between Hernando and Hardee Counties. Eocene and Oligocene formations are fossiliferous limestones, but Miocene rocks are largely unconsolidated sands and clays in which fossils are scarce. Correlation of Miocene strata, therefore, is based mainly on lithology and stratigraphic position. Where rocks are altered by weathering, correlation is based on original rather than present gross lithology. Quartz sand was found to be valuable in correlation because it is not affected by weathering. Rocks previously mapped as the Pliocene Alachua and Bone Valley formations range from lower to middle Miocene and are assigned to the Tampa and Hawthorn formations. The Citronelle formation of Pliocene or later age apparently does not extend into peninsular Florida. Clayey, micaceous sand, which has been considered as an equivalent of Citronelle, is late middle Miocene or early late Miocene in age. Hard-rock phosphate deposits in the area are in beds of early Miocene age, which are assigned to the Tampa limestone. Hard-rock phosphate particles appear to consist of two types: cementation concretions and limestone replacements. Land-pebble phosphate deposits range from middle Miocene to Pleistocene in age. They are chiefly residual deposits of middle Miocene age. Uranium is confined mainly to lower and middle Miocene rocks with the greatest concentrations in the Hawthorn formation. (auth)

2626

DIRECTIONAL RESISTIVITY MEASUREMENTS IN EXPLORATION FOR URANIUM DEPOSITS ON THE COLORADO PLATEAU. George V. Keller. U. S. Geol. Survey Bull. 1083-B. 1959. 39p. $0.20(GPO).

A study of the electrical properties of the Morrison formation in the Uravan mineral belt of the Colorado Plateaus province indicated that there is a significant correlation between electrical resistivity and the relative favorability for occurrence of ore. The differences in resistivity were not large enough to provide a recognizable target for standard resistivity field methods, especially where the ore-bearing sandstone member is more than a few hundred feet deep. Measurement of resistivity trends by placing one electrode in a drill hole and spreading the others out radially on the surface seemed to offer a means of exploiting the resistivity-favorability correlation. Field tests of such directional-resistivity measurements were made in the Spud Patch area in San Miguel County, Colo., and the White Canyon district, San Juan County, Utah. In the Spud Patch area two methods were tried; in one a current electrode was placed in the drill hole, and in the other a potential electrode. The second method was the more tedious but provided the more readily interpretable results. A comparison of the resistivity trends thus determined with the favorability estimated from geologic indexes

indicated that directional resistivity methods could predict the location of favorable areas at distances of 600 to 1000 ft with a high degree of success. In the White Canyon district directional-resistivity measurements were made on the assumption that the conglomerate which is found in many channels filled with the Shinarump member of the Chinle formation has a high resistivity. The measurements were successful in tracing the channel conglomerate where surface conditions were favorable. (auth)

2627

A NEW METHOD FOR THE POTASSIUM–ARGON AGE DETERMINATION AND ITS APPLICATION TO STONE METEORITES. H. Wänke and H. König (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 860-6(1959) Oct. (In German)

Potassium–argon age determinations were carried out by a new method on five chondrites and two achondrites. The method is a neutron activation method, in which potassium and argon are determined by the formation of active argon isotopes. Argon-39 is produced by (n,p) reactions on potassium-39 and argon-41 by (n,γ) reactions on argon-40. Since for the age determination, only the ratio of the activities of Ar^{39} to Ar^{41} is necessary, this method appears especially advantageous as the apparatus expenditure is low. The ages of the meteorites investigated were from 2.78×10^9 to 4.25×10^9 years, and agreed with the values obtained by other methods. Values for the calcium content of the meteorite samples were obtained from the Ar^{37} activities produced by (n,α) reactions. (tr-auth)

HEALTH AND SAFETY INCLUDING DOSIMETRY

2628 AD-322(OZ)

Naval Radiological Defense Lab., San Francisco.

RADIATION LEVEL FROM ABD CONTAMINATION ON LAND AS A FUNCTION OF THE DISTANCE AT WHICH MODERATE DAMAGE IS PRODUCED. Richard D. Wolfe. July 17, 1951. Decl. Apr. 28, 1959. 23p. OTS.

Using the information contained in the Armed Forces Special Weapons Project publication Capabilities of Atomic Weapons, three graphic plots are given which show the relationship between radiation intensity (r/hr at one hour after detonation) and the distance at which moderate damage commences, for six common structural types, and for bombs having a yield from 8 kt to 200 kt. The heights of the bursts considered range from 100 feet below the ground surface to 50 feet above the ground surface. The underwater burst is not considered. (auth)

2629 AECU-4285

Massachusetts Inst. of Tech., Cambridge. [Radioactivity Center].

RADIUM AND MESOTHORIUM POISONING AND DOSIMETRY AND INSTRUMENTATION TECHNIQUES IN APPLIED RADIOACTIVITY. Annual Progress Report. May 1959. 164p. Contract AT(30-1)-952. OTS.

The half-period of thorium-232 was redetermined as 1.41×10^{10} years. The result is in substantial agreement with the half-periods already reported in the literature. The study of radium and mesothorium toxicity in human beings was continued, with emphasis on living persons as distinct from persons no longer living whose dosimetry is reconstructed from bone or tooth samples. Assays of whole-body gamma emission due to radium burdens were made in the controlled background facility. Semiquantitative radium burden estimates were made on 32 individuals by means of breath samples. Over 200 persons with occupational or therapeutic exposure to radioactive materials were located. Over 800 cases of exposure to radium, mesothorium, or their decay products have been located on which some details are available. Data on patients exposed to radioactive materials are being put on punched cards for a central catalog of cases. Data are tabulated on the radium and mesothorium burdens of subjects and pathological conditions in individuals exposed to radioactive materials with particular reference to radium content. Methods of physical dosimetry are discussed. Progress is reported in the development of fast neutron dosimeters. Medical data on patients are appended. (For preceding period see AECU-4422.) (C.H.)

2630 CD/SA-69

Gt. Brit. Home Office. Civil Defence Dept. Scientific Advisers' Branch, London.

THE PENETRATION OF GAMMA RADIATION FROM A UNIFORM CONTAMINATION INTO HOUSES. A FIRST REPORT ON SOME FIELD TRIALS. A. G. McDonald. Jan. 1956. 16p.

An experimental technique for measuring the penetration of ionizing radiation into structures has been developed by the Atomic Energy Research Establishment and the Admiralty Research Laboratory. Using this technique penetration measurements have been carried out on a small bungalow of conventional brick construction which incorporated various protective measures, so that the relative merits of such measures could be objectively measured. Data are presented graphically. (auth)

2631 ORNL-2806

Oak Ridge National Lab., Tenn.

HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1959. Oct. 29, 1959. 221p. Contract W-7405-eng-26. OTS.

Waste Disposal Research and Engineering. Operation of the process waste water treatment plant resulted in the lowest annual discharge on record of radioactivity to White Oak Creek. A study was made of optimum treatments for the removal of cesium-137 and strontium-90 from process wastes. Data are included on studies of soil disposal facilities; dispersion of radioactivity from White Oak Creek in the Clinch River; the development of an improved well probe for radiologging use; studies of waste burial areas; ecological studies in White Oak Lake bed and forest sites of the reservation, combined with studies on the movement and accumulation of radionuclides in vegetation and herbivorous insects; foliage contamination by local and regional fall-out; the containment of fission products by clays and vermiculite; cesium-137 fixation by ion exchange; theoretical considerations and laboratory and field investigations of radioactive waste disposal in cavities in natural salt formations; investigations of the disposal of radioactive wastes into deep wells; an evaluation of hazards associated with tank storage of highly concentrated radioactive wastes; and the selection of a site for a tank form. Radiation Physics and Dosimetry. During Operation Hardtack II (fall of 1958) a detailed study was made of the neutron and gamma radiation dose distributions in facsimiles of typical Japanese dwellings exposed to nuclear bomb radiation. Instrumentation and results are discussed. Data are tabulated on the radiation attenuation characteristics of various building materials. The dosimetry of persons exposed during criticality accidents is discussed with particular reference to the June 1958 accident in the Y-12 area in which eight persons received appreciable doses of radiation. Progress is reported in investigations of the physics of dosimetry. Monte Carlo calculations were made of the

penetration of weapons radiations in air. Progress is reported in studies on thermoluminescence in ferroelectrics; a statistical analysis of radiation aging in which the information theory is applied; electron capture in oxygen mixtures; measurements of light emission from aluminum foil bombarded by electrons; measurements of electron flux in simulated biological media bombarded by x rays; measurements of the stopping power for electrons of thin metal foils; the development of ion chamber-electrometer personnel dosimeters; determinations of the angular response of a partially-shielded cylindrical dosimeter; and the development of a dosimetry program for criticality accidents. Internal Dosimetry. Data are included on 25 dogs exposed to single inhalations of U_3O_8 fumes to determine the biological half-life and per cent retention in the lungs. A Bahco micro-particle classifier was used to separate enriched uranium oxide into several size fractions for use in inhalation exposure studies. An inhalation chamber was designed for the exposure of mice. A portable air sample was designed and built. Data are included from distribution and excretion studies on uranium in rats. A special scintillation counter for measuring the radioactivity of small animals and other samples was designed and built. Analysis of human tissues by emission spectroscopy and flame photometry was continued and data are tabulated on tissues received from Seattle and Tacoma, Washington. The chemical composition of tissues from American and foreign adults is compared. Calculations were made of the radiation dose to gonads from radionuclides present in food and water, and the dose to the gastrointestinal tract from ingested radionuclides. Related cooperative projects are summarized; education, training, and consultation services are outlined; and a list is included of publications, papers, and lectures during the period. (For preceding period see ORNL-2590.) (C.H.)

2632

ON ESTIMATING TOTAL RADIATION DOSAGE FROM A COMPARTMENTALIZED ISOTOPE. Austin M. Brues and Sylvanus A. Tyler (Argonne National Lab., Lemont, Ill.). Atompraxis 5, 253-6(1959).

Time-retention relations in an open steady-state, isotopically labelled system are extremely complex where more than two compartments are involved. Using the concept of mean retention time, however, it is shown that all compartments of such a system have an equal relative "dose" (total disintegrations per unit amount of the material labelled), or less. The "dose" is less where the decay constant of the isotope is not large relative to retention time, or where the true size of the compartment is overestimated. Exceptions to this general rule occur only under conditions where the system is not in a steady state. If an irreversible synthesis occurs (as of DNA) only during the period of high external activity, the disintegrations may far exceed those predicted by the steady-state rule. Where the turnover rate decreases with age, or where it is retarded as a result of isotopic irradiation, the radiation dose predicted by this rule may also be exceeded. In cases where the steady state is approximated, as in the case of most C^{14}- and tritium-labelled compounds, the rule of equal relative "dose" gives a true maximum value for the radiation exposure. (auth)

2633

RESULTS OF RADIATION-PROTECTION MONITORING BY THE FILM BADGE METHOD IN THE YEARS 1957 AND 1958. Walter Brichzy and Felix Wachsmann (Arbeitsgemeinschaft für Strahlenschutz, Erlangen, Ger.). Atompraxis 5, 305-10(1959). (In German)

Approximately 40,000 radiation-protection badges and rings which were evaluated in 1957 and 1958 are used to give statistics on radiation exposure in various groups, which are listed according to type and length of employment, professional and age groups, size of factory and laboratory, etc. The following findings are of particular importance. Radiation exposure has generally decreased over the years. It is relatively high in the professionally less qualified and older groups, and in those employed in medium-sized plants. Obviously, persons who work with radium (gynecologists) are particularly endangered. Radiation exposure in other countries is generally higher than in Western Germany. (auth)

2634

THE DECREASE OF THE PERSONAL DOSE BY AN INDIVIDUAL RADIATION-WARNING APPARATUS. Dietrich Frost (Städt, Rudolf-Virchow-Krankenhaus, Berlin and Entwicklungsabteilung der Dr. H. Stamm KG., Berlin). Atompraxis 5, 310-13(1959). (In German)

The possibilities of individual radiation warning are discussed. The best solution proved to be an alarm sound, the frequency of which increases in proportion to the dose. A battery-run pocket warning device and its use in clinical work are described. (auth)

2635

ON THE METHOD OF ESTIMATION OF THE POPULATION DOSE, POPULATION, AND SURFACE AREA COVERED BY THE DIFFUSION OF RADIOACTIVE CLOUDS. Y. Nishiwaki (Osaka City Univ.). J. Atomic Energy Soc. Japan 1, 1-8(1959) June. (In Japanese)

It is very important from the health physics point of view that the population dose, the population, and the surface area covered by the diffusion of radioactive clouds be estimated approximately even as an order of magnitude. Formulas to calculate the population dose, population, average dose, and surface area of the isopleth are derived by different methods of approximation of Sutton's diffusion formula. The values for the surface areas calculated from these formulas are compared with those obtained by the graphical integration of the original Sutton's formula for the continuous point source on ground level. The results of the analysis indicate that the approximation of Sutton's formula by an ellipse with one half of the maximum downwind interaction distance (r/2) as one half of the major axis and either the maximum crosswind distance (Y_{max}) or the crosswind distance corresponding to one half of the maximum downwind distance ($Y_{(r/2)}$) as one half of the minor axis, or the approximation by expanding Y^2 of Sutton's formula in Taylor series of x giving Y_{max} and taking up to the term of x^2, gives a better approximation than expanding the exponential of the Sutton's formula and keeping only the first two terms. (auth)

2636

A FILM DOSIMETER FOR RADIATION PROTECTION CONTROL IN CLOSE ASSOCIATION WITH RADIOACTIVE ISOTOPES. G. Böhler (Deutschen Akademie der Wissenschaften, Berlin-Buch). Kernenergie 1, 1045-51 (1958). (In German)

A film badge is described which is made up of 3 plates in a protective plastic envelope. The front (or back) plate is 1-mm thick Al 36 × 43 mm with 13-mm holes 0.5 mm deep. Two holes are inlaid with 1-mm Pb one of which is plated on the upper surface with 18 mg/cm^2 Al foil. Between the front and back plates an open frame of 1-mm Al is riveted so that the Al plating shows and the open space remains clear. The photo emulsion is placed between 7 mg/cm^2 specific surface weight black paper

for protection. This surface weight is important because the film must be inserted in the slit between the plates. Radioactive contamination of the protective cover can be readily removed by exchanging it. The total weight of the plaque is 18 gm. By means of the two lead windows gamma dosimetry is accomplished, and the other two windows are for β dosimetry. The performance of this arrangement is demonstrated with curves of film darkening versus radiation energies. (T.R.H.)

2637

THE MESURATION OF AIR ACTIVATION PRODUCED BY BETATRON IRRADIATION. Dietrich Harder, Julius Kretschko, and Wolfgang Pohlit (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 110, 234-9(1959).

The activation of the air, as it occurs during irradiation by a betatron due to nuclear photo effects, was estimated and determined by an ionization chamber device. At a dose output of 50 rad per minute at 1.0 m target distance an activity of the air of 3×10^{-11} curies per cm^3 is created due to activation of oxygen. This is 7 times the permissible maximum exposure of whole body irradiation (critical organ: skin). The incorporation of active oxygen is negligible. The activation of nitrogen after an irradiation of 10 minutes duration creates an activity of the air of 1.5×10^{-12} curies per cm^3, which is $\frac{1}{4}$ of the maximum permissible concentration. The penetration of air from the therapy room into the control room must be avoided. The radiation exposure of the patient is only about one thousandth of the tumor dose. (auth)

2638

THE DISTRIBUTION OF NEUTRONS FROM BETATRON IRRADIATION OCCURRING IN PHANTOMS. Wolfgang Pohlit (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 110, 240-7(1959).

The distribution of the neutrons of betatron irradiation was studied in water and paraffin by means of indium probes. It was demonstrated that the neutrons which come from the outside originate from material of high atomic weight (lead). They decrease in the phantom in an exponential function (in paraffin: half value layer 5.8 cm). The neutrons originating from the reaction $C^{12}(\gamma,n)C^{11}$ first increase towards the depth and reach their maximum at a depth of about 10 cm paraffin. Beyond this depth they decrease very gradually according to the weakening of the photons in an exponential function (half value layer about 50 cm paraffin). Both neutron flows are of the same quantity of 10^4 n/cm^2 sec at a dose output of 50 rad per min at a target distance of 1 m under normal conditions. (auth)

2639

EMPLOYEE RADIATION HAZARDS AND WORKMEN'S COMPENSATION. HEARINGS BEFORE THE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON EMPLOYEE RADIATION HAZARDS AND WORKMEN'S COMPENSATION, MARCH 10, 11, 12, 17, 18, AND 19, 1959. Washington, D. C., Joint Committee on Atomic Energy, 1959. 864p.

The subcommittee on Research and Development, Joint Committee on Atomic Energy, met on March 10, 1959 to continue hearings begun in 1956 on employee radiation hazards and workmen's compensation. Subjects covered included the general background of the broad problem of industrial radiation hazards; examples of experience at individual installations; current Federal, State, and private activities with regard to prevention of radiation accidents to employees; application of workmen's compensation laws to radiation injuries; and proposed changes in laws. (C.H.)

ISOTOPE SEPARTION

2640 ORO-216

Virginia. Univ., Charlottesville. Research Labs. for Engineering Sciences.

THE DEVELOPMENT OF SHORT BOWL ULTRACENTRIFUGES. Progress Report. Gernot Zippe. Nov. 6, 1959. 22p. Contract AT(40-1)-2400. (EP-59-2400-2). OTS.

Progress in uranium isotope separation by the ultracentrifuge method is reported. Construction and life time testing of centrifuge mechanical prototypes are described including operation of two such prototypes for a year. High speed spin tests are also described and materials which yield at 402 ± 0.3 meters/sec were tested. Development of molecular pumps for maintenance of vacuum around spinning rotors is reported as well as research on a scoop system for insertion and extraction of gas from the centrifuge. Preliminary measurements of isotope separation are reported and data on efficiency are included. Also, information on engineering and economic aspects of rotor design are included. (J.R.D.)

2641 AERE-Trans-835

ELECTROLYTIC SYSTEMS WITH COLUMNS FOR THE RECOVERY OF DEUTERIUM BY THE EXCHANGE REACTION. [PART II]. E. Cerrai, C. Marchetti, M. Silvestri, and S. Villani. Translated by R. J. Royston (U.K.A.E.A. Atomic Energy Research Establishment) from report CISE-62, July 30, 1954. 81p.

Part I issued as AERE-Trans-834 (CISE-61, July 30, 1954).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 8611.

2642

A FUNDAMENTAL STUDY ON THE ION-EXCHANGE SEPARATION OF ISOTOPES. H. Kakihana, S. Nomura, H. Fukutomi, H. Ohtaki, and K. Yamasaki (Tokyo Inst. of Tech.). J. Atomic Energy Soc. Japan 1, 46-52(1959) June. (In Japanese)

It is observed that heavy water is taken up by differently cross-linked sulfonated cation exchangers slightly easier than light water. The selectivity coefficient, K_{23}^{24} (Na), between Na^{23} and Na^{24} on the resins is determined in ethanol–water mixtures containing NaCl. The values of K_{23}^{24} (Na) lie between 0.89 ~ 1.07. The relationship between empirical and thermodynamical equations for the K_{23}^{24} (Na) selectivity coefficient are used to explain the variation of the values and to find the better conditions for the isotope separation. (auth)

2643

PRODUCTION AND APPLICATIONS OF STABLE ISOTOPES. N. M. Zharvoronkov, S. I. Babkov, V. Yu. Orlov, K. I. Sakodynskii, N. N. Sevryuzova, V. A. Sokol'skiĭ, and G. N. Chernykh. Khim. Nauka i Prom. 4, 487-98(1959). (In Russian)

The production, separation, and applications of stable isotopes in industry and in scientific and technological laboratories are reviewed. 240 references. (R.V.J.)

2644

HEAVY WATER PRODUCTION METHODS. Ya. M. Varshovskiĭ and S. E. Vaisberg. Khim. Nauka i Prom. 4, 498-509(1959). (In Russian)

An analysis is presented of various methods for pro-

ducing D_2O. Descriptions are given of the dual-temperature H_2S method, which is considered the most efficient for industrial production, and of the low-temperature liquid–hydrogen rectification method, which is the only other method economically feasible. (R.V.J.)

2645

INDUSTRIAL METHODS FOR THE PRODUCTION OF HEAVY WATER. N. M. Zhavoronkov and K. I. Sakodynskii. Khim. Prom. No. 3, 35-48(1959).

A detailed survey is given on industrial methods of producing heavy water, including data on world-wide methods which are projected, completed, or are being carried out. The various methods of developing and separating deuterium are theoretically dealt with, as well as electrolysis, the chemical exchange of isotopes and the rectification of water and hydrogen; the corresponding data are given. Factories in the western countries established for the production of heavy water are mentioned which use the electrolytic method, the rectification of water and the distillation of hydrogen, and the double-temperature method. Diagrams are given and industrial and commercial data are shown. Hydrogen distillation method was the first to be introduced in USSR industry, deuterium was extracted from electrolytic hydrogen by low-temperature rectification. The latter production is the only example given for the production of heavy water in a country other than western and is described in detail. A table is also given with data on works and firms in western countries which deal or dealt with the production of heavy water. Finally comparisons are made between the various methods of producing heavy water, and the corresponding data are given of some works in the western countries. (TCO)

2646

SEPARATING ISOTOPES OF URANIUM. DEVELOPMENT OF AN INDUSTRIAL-SCALE PROCESS. F. I. Hurley (United Kingdom Atomic Energy Authority, Capenhurst, Ches., Eng.). Research (London) 12, 417-23(1959) Oct.-Nov.

The design problems encountered in establishing the gaseous diffusion process for separating uranium isotopes on an industrial scale are described. (C.J.G.)

2647

ISOTOPE SEPARATION IN MOLECULAR PUMPS. W. Fischer and A. Klemm (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 851-60(1959) Oct. (In German)

The compression and segregation of gases in molecular pumps was calculated as a function of the throughput in the case of molecular and viscous flow matrix. The theory was essentially confirmed by experiments on two commercial pumps. Only a compression maximum observed at 1 to 10 Torr preliminary vacuum pressure was unexplained. The separation factors observed corresponded to a tenfold multiplication of the element effect. As an example, the separation factor of 1.5 was obtained for neon isotopes (element effect was $\sqrt{22/20}$). (tr-auth)

2648

A METHOD AND APPARATUS FOR THE SEPARATION OF ISOTOPIC IONS. Norbert Roger Beyrard-Benchemoul and Carel Jan Van Oss. British Patent 823,283. Nov. 11, 1959.

A method and apparatus for separating isotopic ions by means of an opposed electric field and centrifugal force is described. The combined effect of centrifugal force and radial electric field can be adjusted to completely separate a heavier ion from a lighter one in one operation. Centrifugal accelerations of the order of 10^6g are required and are obtained by causing the solution of ions to be separated and to be pumped at high linear speed through a spiral conduit. The spiral groove is lined with a conducting tape on which ions may be electrolytically deposited. Means for regulating flow rate and electric field strength are given. (T.R.H.)

2649

CHARGE BOTTLE FOR A MASS SEPARATOR. P. H. Davidson (to U. S. Atomic Energy Commission). U. S. Patent 2,894,135. July 7, 1959.

Improved mass separator charge bottles are described for containing a dense charge of a chemical compound of copper, nickel, lead or other useful substance which is to be vaporized, and to the method of utilizing such improved charge bottles so that the chemical compound is vaporized from the under surface of the charge and thus permits the non-volatile portion thereof to fall to the bottom of the charge bottle where it does not form an obstacle to further evaporation. The charge bottle comprises a vertically disposed cylindrical portion, an inner re-entrant cylindrical portion extending axially and downwardly into the same from the upper end thereof, and evaporative source material in the form of a chemical compound compacted within the upper annular portion of the charge bottle formed by the re-entrant cylindrical portion, whereby vapor from the chemical compound will pass outwardly from the charge bottle through an apertured closure.

2650

CALUTRON RECEIVER. H. F. York (to U. S. Atomic Energy Commission). U. S. Patent 2,894,137. July 7,1959.

A receiver construction is presented for calutrons having two or more ion sources and an individual receiver unit for each source. Design requirements dictate that the face plate defining the receiver entrance slots be placed at an angle to the approaching beam, which means that ions striking the face plate are likely to be scattered into the entrance slots of other receivers. According to the present invention, the face plate has a surface provided with parallel ridges so disposed that one side only of each ridge is exposed directly to the ion beam. The scattered ions are directed away from adjacent receivers by the ridges on the face plate.

2651

SLIT ADJUSTMENT CLAMP. K. R. McKenzie (to U. S. Atomic Energy Commission). U. S. Patent 2,894,138. July 7, 1959.

An electrode support which permits accurate alignment and adjustment of the electrode in a plurality of planes and about a plurality of axes in a calutron is described. The support will align the slits in the electrode with the slits of an ionizing chamber so as to provide for the egress of ions. The support comprises an insulator, a leveling plate carried by the insulator and having diametrically opposed attaching screws screwed to the plate and the insulator and diametrically opposed adjusting screws for bearing against the insulator, and an electrode associated with the plate for adjustment therewith.

MATHEMATICS AND COMPUTERS

2652 APEX-520

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

A NUMERICAL SOLUTION TO THE ANGLE-INTEGRATED

BOLTZMANN EQUATION. J. H. Bennett and J. R. Terrall. Nov. 20, 1958. 12p. Contracts AF33(600)-38062 and AT(11-1)-171. OTS.

A numerical method of solution of the Boltzmann transport equation is considered for two separate cases. The first case is that of a single scattering element, which scatters isotropically and elastically. In the second case, the only approximation is that the leakage is defined as proportional to the flux. Expressions are derived from which the numerical solution may be obtained in each of the two cases. In the first case the expressions are reasonably simple. In the second, the amount of work involved because of the amount of data required may be prohibitive. (auth)

2653 NYO-2878

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

A DUALITY THEOREM FOR CONVEX PROGRAMS. W. S. Dorn. Aug. 1, 1959. 22p. Contract AT(30-1)-1480. OTS.

A proof is given for a dual theorem for a class of convex programs, i.e., constrained minimization of convex functions. A simple example is included. (auth)

2654 WAPD-TM-143

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

TKO—A THREE-DIMENSIONAL NEUTRON-DIFFUSION CODE FOR THE IBM-704. W. R. Cadwell. Oct. 1959. 44p. Contract AT-11-1-GEN-14. OTS.

A description is given of a code for the IBM-704 computer which solves the few-group, time-independent, neutron-diffusion equations in x, y, z geometry. The number of lethargy groups may be one, two, three, or four, and the solution is obtained over a rectangular parallelepiped which is symmetric with respect to the plane x = y. A mesh of horizontal and vertical planes is imposed on this parallelepiped; all region interfaces must occur on mesh planes. Input parameters are specified regionwise, and completely variable mesh spacing is permitted. The number of mesh points on and to one side of the plane x = y is limited to 2675 and 4725 on 16,384-word and 32,768-word computers, respectively. Either a zero flux or a zero current boundary condition may be applied at each boundary plane. The code was constructed to provide great ease of input preparation and simplicity of code operation. The running time of a typical two-group, 2600-point problem is 1.5 hours. (auth)

2655 XDC-58-2-204

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

NUCLEAR DATA TAPE PROGRAM (704 PROGRAM NDTP). Kathryn Paine. Dec. 20, 1957. 46p. OTS.

The Nuclear Data Tape Program compiles, from certain minimal input data, a tape containing nuclear data used by GE–ANPD reactor analysis programs C_2, G_2, and George, on the IBM 704 computer. Provision is made for listing the tape, punching binary cards from which a new tape can be made, modifying a record, adding new records, adding a modified record, or omitting a record. (auth)

2656

PHYSICAL MEANING OF THE IMPORTANCE EQUATION. M. Otsuka (Electric Power Development Co., [Japan]). J. Atomic Energy Soc. Japan 1, 174-6(1959). (In Japanese)

Since the importance function has the clear meaning in the reactor theory, the importance equation should also have a certain physical meaning. In the present paper the importance equation and its boundary condition in the diffusion approximation are examined. It is shown that the equation and the boundary condition are based on the same physical approximation as the original reactor equation, to which the importance equation is adjoint. (auth)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

2657 AECU-4456

Knolls Atomic Power Lab., Schenectady, N. Y.

MAGNESIUM OXIDE (MgO). C. F. Barrett, Jr. Mar. 26, 1954. 2p. (KAPL-Spec-O-KPM7-1(Rev.1)). OTS.

Specifications for MgO raw materials and parts are presented. Included are testing, sampling, and analytical methods, and requirements for fabrication. (J.R.D.)

2658 AECU-4468

Bureau of Mines. Electrometallurgical Experiment Station, Boulder City, Nevada.

PURE METALS PROJECT, ZIRCONIUM AND HAFNIUM PROGRAM. Quarterly Progress Reports No. 1 through 6 for November 1, 1956 to June 30, 1958. 72p. Contract AT(11-1)-475. OTS.

Six quarterly progress reports are presented on the electrorefining of Zr and Hf. (W.L.H.)

2659 CF-59-11-24

Oak Ridge National Lab., Tenn.

THE EFFECT OF CLOSED POROSITY ON THE ACCURACY OF THE MODEL FOR FISSION-GAS RELEASE FROM UO_2. M. W. Rosenthal. Nov. 10, 1959. 14p. Contract [W-7405-eng-26]. OTS.

The presence in UO_2 compacts of closed pores capable of retaining fission-product gases introduces a factor which is not considered in the normal treatment of fission-gas behavior. An analysis indicates that if a "no-closed-porosity" model is used to obtain diffusion coefficients from short-term experiments, and the same model employed to predict the gas release under power reactor conditions, the predicted value will be correct for the initial part of the exposure. However, for longer periods, the estimated release will be greater than would actually occur. Measurement of the fraction of evolved gas which is trapped in pores during an anneal of exposed UO_2 would provide a parameter which could be used in mathematical treatments of the problem to allow for the effect of closed porosity. (auth)

2660 CTR-349 through 351

Office of Technical Services, Washington, D. C.

TITANIUM. Parts I through III, 1920-58. Catalog of Technical Reports. 28p. OTS.

These three parts were issued separately, but are cataloged as a unit.

2661 HW-60689

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FISSION PRODUCT RELEASE FROM URANIUM HEATED IN AIR. R. K. Hilliard. Aug. 3, 1959. 36p. Contract AT(45-1)-1350. OTS.

The release of fission products from small cylindrical specimens of normal uranium heated in an air stream was investigated in a laboratory study. The specimens were irradiated to 2.4×10^{14} nvt and allowed to cool one to three days before testing. Heating was accomplished out of pile

in a resistance furnace with air flowing over the specimen. The off-gas stream was scrubbed free of radioactive material by suitable traps. Analyses were performed on the volatilized portion and on the dissolved residue to determine the fraction of fission products released. Analyses were made for I^{131}, Te^{132}, Xe^{133}, Sr^{89}, Cs, Ru^{103}, Ba^{140}, and Zr^{95}. Twenty-nine tests were performed with air and one with a helium atmosphere. The furnace temperature was varied from 425 to 1440°C while the time of heating varied from 2.5 to 232 minutes. The efficiencies of various filter media for retaining air-borne radioactive matter were investigated. An unsuccessful effort was made to separate the particulate from the elemental release. Data gathered in these tests were correlated to show the effects of temperature, time of heating and per cent of metal oxidized on the release coefficient for the fission products investigated. (auth)

2662 HW-62109

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN ESTIMATION OF THE EXPLOSION HAZARD DURING REPROCESSING OF METALLIC URANIUM FUEL ELEMENTS METALLURGICALLY BONDED TO ZIRCALOY CLADDING. J. L. Swanson. Sept. 30, 1959. 10p. Contract AT(45-1)-1350. OTS.

Experimental studies were performed to define the behavior in ammonium fluoride solutions of uranium-zirconium alloys and of explosive residues isolated from such alloys. The results indicate that once the diffusion layer existing between the uranium core and the Zircaloy cladding is exposed to such solutions, it will readily and completely dissolve, thus eliminating the possibility of this portion of the diffusion layer entering into an explosive reaction with nitric acid. Because of the probability that the Zircaloy cladding (and, therefore, the diffusion layer) will not be completely removed from the uranium prior to the nitric acid core dissolution step, consideration was also given to the magnitude of a possible explosive reaction resulting from the exposure of the diffusion layer to nitric acid. It is concluded that the probability of an explosive reaction of sufficient magnitude to pressurize a dissolver during normal plant operations is very remote. (auth)

2663 KAPL-2009

Knolls Atomic Power Lab., Schenectady, N. Y.

THERMAL CYCLING TEST OF TYPE 347 STAINLESS STEEL IN-PILE TUBES. S. Bigelow. Mar. 17, 1959. 24p. Contract W-31-109-Eng-52. OTS.

Because of the large gamma heat generation in the core of the Engineering Test Reactor, the thermal stresses in the KAPL ETR F-10 and the BAPD-KAPL 6 × 6 in-pile tubes result in fatigue and possible growth in the diameter of the tube. To prove the operability of these in-pile tubes, a scaled-down section of in-pile tube was installed in the KAPL HF-2 loop, a high-temperature, high-pressure, heat transfer facility. The tubular test section was alternately heated and cooled for a total of 10,020 thermal cycles and 8 pressure cycles. The maximum tangential stresses were 16,570 psi due to pressure and 98,680 psi due to internal heat generation. The test section was inspected several times during the test, and no evidence of growth or cracking was observed. (auth)

2664 MAB-53-SM

National Research Council. Materials Advisory Board.

STAFF STUDY ON ADEQUACY OF CURRENT RESEARCH PROGRAMS IN THE FIELD OF HIGH STRENGTH STEELS FOR ELEVATED TEMPERATURE APPLICATIONS IN AIRCRAFT. Edmund V. Bennett. Oct. 30, 1959. 68p. Contract DA-36-039-sc-76436.

Various governmental agencies and laboratories were visited, and research programs in being or contemplated in the field of airframe steels were fully reviewed. A select number of private research organizations were also called upon and appropriate projects, received from both governmental agencies and private industry, noted. One hundred nine airframe steel research projects were located and reviewed, indicating a program adequacy much better than anticipated and with comparatively little duplication of effort. Fifteen additional problems appear to be of sufficient importance to warrant the initiation of new projects, but only about half of these are of such nature that Department of Defense sponsorship is indicated. (auth)

2665 MND-2081

Martin Co. Nuclear Div., Baltimore.

LITERATURE SURVEY ON URANIUM MONOCARBIDE. J. L. Kane. July 15, 1959. 20p. OTS.

A literature survey is presented covering only the unclassified literature on uranium monocarbide, which is considered the only thermodynamically stable specie at room temperature. (auth)

2666 MND-E-2007

Martin Co. Nuclear Div., Baltimore.

ERDL—NPFO—QUARTERLY PROGRESS REPORT NO. 9. FOR JULY THROUGH SEPTEMBER 1959. C. Eicheldinger. Oct. 1959. 33p. Contracts DA-44-009-ENG-3581 and DA-44-192-ENG-6.

Preliminary autoclave tests on Inconel were completed. Average corrosion rate was 0.35 mpy and the maximum corrosion rate on any single specimen was 0.90 mpy. The corrosion loop operated at 78% utilization during this quarter. Testing of MOD SG-5 and SH-5 (Croloy 16-1) vessels is continuing. At the end of this quarter, 2691 hours of testing had been accumulated. Testing of MOD SG-6 and SH-6 (Inconel) vessels is also continuing. At the end of this quarter, 2008 hours of testing had been accumulated. MIN-4 (Croloy 16-1) was removed from the loop after 2578 hours of testing. Heavy corrosion-product buildup on the tubes was noted at the vapor-liquid interface. MIN-5 (Croloy 16-1) was removed from the loop after 941 hours of testing. Corrosion-product buildup was considerably greater than that noted on MIN-4. MIN-9 (Inconel) was removed from the loop after 2631 hours of testing. Examination revealed very little attack on tubes and tube sheet. MIN-6 (Croloy 16-1) and MIN-8 (Inconel) remain in the loop for further testing. The cosine-contoured heat transfer test section was received from the fabricator. The unit does not meet dimensional specifications. The uniform heat transfer test section was checked out in the loop and found to operate satisfactorily. One hundred kilowatts of electrical power was applied to the test section during checkout. A test program was initiated on the uniform test section. During this program, a short circuit developed between the channel and the backup plate. The test section failed due to meltdown of the channel wall. The damaged uniform test section is being rebuilt. The new technique for fabricating the test channel will be used. The heat transfer data reduction code has been written, assembled on the IBM-704, and partially checked out. The code is ready for reassembly on the IBM-709. (For preceding period see MND-E-2006.) (auth)

2667 NAA-SR-Memo-3893

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A BRIEF LITERATURE SURVEY OF HIGH STRENGTH

ZIRCONIUM ALLOYS WITH EMPHASIS ON THE ZIRCONIUM–NIOBIUM–X TERNARY SYSTEMS. C. Hays. May 22, 1959. 11p. OTS.

Recent work on Zr–Nb and Zr–Nb–X alloys is discussed. The program is being initiated for the purpose of developing a Zr-base alloy which will exhibit only 1% deformation at 1250°F under 5000 psi stress for the duration of 10,000 hours. (W.L.H.)

2668 NAA-SR-Memo-4270

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

COMPATIBILITY OF UO_2 AND APM-M-257. K. Langrod. Aug. 18, 1959. 5p. OTS.

The compatibility of M-257 and 1100 Al pellets with UO_2 pellets at 1100°F was investigated. Results showed that there was no reaction between UO_2 and either M-257 or 1100 Al after 14- and 30-days exposure at 1100°F. (W.L.H.)

2669 NP-8039

Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION OF SINTERABLE POWDERS AND BERYLLIUM OXIDE PROPERTIES. Quarterly Progress Report No. 3 covering period: August 1 through October 31, 1959. J. E. Johnson, A. K. Smalley, and W. H. Duckworth. Nov. 13, 1959. 7p. Contract AF33(616)-6238.

The structure and strength of ceramics made from sinterable oxide powders, especially BeO, were investigated. Attention was given to relations between strength and microstructure and to the effect of powder characteristics and processing variables on microstructure. An experiment was made to evaluate the strength of ceramics made from BeO powders prepared by calcining a sulfate at five different temperatures and sintered under various conditions. Sintered specimens were measured for modulus of rupture and bulk density, after which samples of each group were analyzed by spectrographic and microscopic methods. (auth)

2670 NP-8051

Battelle Memorial Inst., Columbus, Ohio.

DEFENSE METALS INFORMATION CENTER. SELECTED ACCESSIONS. M. J. Wahll, comp. Sept. 1, 1959. 91p.

This annotated bibliography contains information on the following subjects: light metals, refractory metals, high-strength alloys, and miscellaneous metals. Numerical, author, and subject indexes are included. (W.L.H.)

2671 ORNL-1033

Oak Ridge National Lab., Tenn.

QUARTERLY PROGRESS REPORT FOR PERIOD ENDING APRIL 30, 1951. E. C. Miller and W. H. Bridges, eds. Oct. 23, 1951. Decl. Oct. 9, 1959. 82p. Contract W-7405-eng-26. OTS.

Experience in extruding rods and tubing of thorium indicates that fabrication by extrusion is completely feasible. The extrusion die design and materials present the greatest problems because of the peculiar flow of thorium during extrusion and the high erosion rate. Thorium tubing clad inside with zirconium was extruded satisfactorily. Work is continuing in order to obtain better surfaces and uniformity of cladding. The thermal cycling of thorium and uranium in Na-K has shown no real deformation of the thorium, but oxide scale formation with significant penetration did occur. An investigation on thorium welding was started, and successful butt, edge, and lap welds were made, using Heliarc techniques. The static corrosion testing of construction materials in a liquid-metal environment has continued. Work has started on the corrosion testing of various materials exposed to fused salts. Dynamic corrosion testing using thermal convection loops containing sodium, lead, and lithium is being carried on jointly with the Experimental Engineering Section of the ANP Division. Stainless steel types 347, 321, and 310; Inconel; and Haynes Alloy 25 displayed very little attack by sodium in 1000 hr at 1500°C. The welds are still the vulnerable areas, and various welding techniques need investigation to determine the best way to eliminate this source of failure. Work on the fabrication of solid type fuel elements for high-temperature reactors is progressing. New types of perforated or mechanically deformed metal plates which can be loaded with UO_2 and clad are being considered. The pressed and clad type in which the UO_2 and a metal powder are pressed and then clad by hot rolling shows good continuous metallic network even up to 50% UO_2, and good bonding to the cladding material can be obtained. The spray coating of a metal surface onto massive beryllium oxide is being attempted; however, evaluation of the bond is difficult. The differences in thermal expansion between the BeO and the metal have led to the consideration of coating with some of the more refractory metals. The Welding Laboratory is engaged in a program to develop suitable techniques for welding Inconel tubing of small diameter to headers. Thus far manual inert-arc welding has been used, but equipment is being assembled to operate a semiautomatic cone-arc apparatus. Recovery in copper at room temperature is being investigated by x-ray methods. An analysis of the (331) line in the copper pattern indicates that in copper filings recovery is complete in about one month. (auth)

2672 ORNL-1108

Oak Ridge National Lab., Tenn.

METALLURGY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1951. E. C. Miller and W. H. Bridges, eds. Feb. 6, 1952. Decl. Oct. 9, 1959. 92p. Contract W-7405-eng-26. OTS.

The effect of strain rate on the tensile properties of thorium is being investigated. It was found that the yield strength increases slightly with increasing strain rate, and that tensile strength increases but to a lesser extent. The shear modulus was determined to be 4.26×10^6 psi. A precision measurement of the lattice parameter of iodide-process thorium was made, giving a value of 5.0871 ± 0.0002 A. Studies on the fabrication of thorium by extrusion and drawing were continued, as were studies on the extrusion cladding of thorium and uranium with zirconium. In order to determine whether or not the type of preferred orientation developed in α-extruded uranium rod was dependent on the actual extrusion temperature, x-ray-diffraction studies were made of completely recrystallized and unrecrystallized extruded uranium. The results show that the texture developed upon deformation is not always retained upon recrystallization. The corrosion testing of various metals and alloys in liquid sodium, lead, and lithium and in molten fluorides and hydroxides was continued. The interaction of sodium with 316 stainless steel appears negligible during static testing. The testing of the molten media in thermal convection loops continues to be plagued by failures other than corrosion. The investigation of means of fabrication of solid fuel elements by powder metallurgy techniques has progressed. Only minor segregation of UO_2 in an iron matrix was noted after hot rolling. Stainless steel matrices, on the other hand, displayed considerable segregation. Rubberstatic pressing was added as a technique for the fabrication of fuel elements and control rods. The Creep Laboratory is essentially complete. The study of thermocouple stability in vacuum has shown that chromel-alumel couples give consistent checks with control and reference temperatures, whereas iron-constantan

and platinum–10% rhodium couples gave erratic results. Some preliminary results were obtained on uranium, thorium, 316 stainless steel, Inconel, and columbium. The evaluation of welded tube-to-header joints of Inconel received considerable attention. Tests in tension show that the joint is of the same order of magnitude as the original material, the failures occurring in the zone adjacent to the weld. A rotating tubular beam fatigue test apparatus was developed, and preliminary tests show that joints with complete penetration have better fatigue life than joints with 70% penetration. The establishment of a ceramics laboratory proceeded satisfactorily. Basic research, engineering development, and service work will be done. In research on the fundamentals of liquid metal—solid metal interaction, the immersion of copper in liquid bismuth resulted in the deposition of copper crystals removed from the specimen. This might be the result of one or more mechanisms: thermal gradients, thermal cycling, or free energy changes. A program to investigate the alloys of the transition elements in order to reconcile the theories of Mott and Jones, and Pauling concerning these elements was initiated. At present the program will concern itself with Group IV-A elements: titanium, zirconium, and hafnium. Zirconium alloyed with nickel and with tungsten is being studied. Thus far the nickel alloy up to 4.08% by weight of nickel quenched in various ways has been studied. (auth)

2673 ORO-209

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

FUSED SILICA FOR REACTOR APPLICATIONS. Progress Report No. 1 [for] November 14, 1958 to August 15, 1959. J. D. Fleming and J. W. Johnson. 66p. Project No. B-153. Contract AT(40-1)-2483. OTS.

Techniques were developed for determining the tensile strength of slip cast fused silica from room temperature to 1800°F. The variation of modulus of rupture of the slip cast fused silica with firing conditions was investigated. A technique for the determination of permeation coefficients for gas flow through the silica was developed using tracer techniques. Basic x-ray-diffraction techniques were applied to the analysis of silica for cristobalite content. Studies were initiated in the fields of optical and electron microscopy and selected area electron diffraction to determine the nature of the cast silica microstructure. Procedures were developed for casting, single piece shell and tube heat exchangers of fused silica. (W.L.H.)

2674 WADC-TR-59-381

Utah. Univ., Salt Lake City.

CERAMIC STUDIES SUMMARY TECHNICAL REPORT. Period Covered: June 1958 to April 1959. P. Gibbs, G. S. Baker, E. K. Beauchamp, and M. H. Miles. May 1959. 18p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-5876. OTS.

Progress is reviewed in the preparation of high purity and doped sintered alumina samples. A high-precision fast-recording, bending creep furnace with resolution of at least 10^{-6} strain in the outer fiber is described. Preliminary tests suggest a stick-slip behavior with jumps of about 5.10^{-5} strain in the outer fiber. Progress in an electrical study of corundum-metal interface is reviewed. Migration of silver ions from a coating is found above 200°C on application of several volts/cm. The observed conduction current rises to an asymptotic value of nearly an amp in seconds. The rise time for this process depends upon the temperature as well as the length of time during which the specimen "rested" without any field. The value of the asymptotic current was greatest at about 350°C. (auth)

2675 HW-tr-8

USE OF THE ELECTRON MICROSCOPE FOR DIRECT EXAMINATION OF THIN FILMS OF METALS AND ALLOYS. PARTS I AND II. C. Beauvais. Translated by Liz Appleby (Hanford Atomic Products Operation) from Metaux Corrosion–Inds.) 34, 247-57; 291-301(1959). 40p. JCL.

Methods for preparing thin films for examination by electron microscopes are described. Results are discussed and electron micrographs obtained by these methods with single and polyphase metals, and alloys are presented. It is pointed out that films of a great number of metals and alloys can be prepared in suitable form for examination by this method. A study based on electron microscopic methods but completed by other methods is included. (J.R.D.)

2676

SMALL ANGLE INTENSITIES FROM DOUBLE REFLECTIONS IN POWDER SAMPLES. B. E. Warren (Massachusetts Inst. of Tech., Cambridge). Acta Cryst. 12, 837-41 (1959) Nov.

A small angle intensity is to be expected from double reflections in any powder sample comprising small grains with random orientation. The inter-grain contribution is due to an hkl reflection in one grain, followed by the same hkl reflection in another grain. The intra-grain contribution arises from a hkl reflection followed by a hkl reflection in the same grain. The inter-grain intensity is independent of grain size and falls off inversely as the scattering angle. The intra-grain intensity depends upon grain size, and falls off rapidly with scattering angle. Equations are obtained for both types of contribution. Cold work in a sample breaks up the original grains into small sub-grains with a small variation in orientation. The enhanced inter-grain contribution from these groups of subgrains can produce a strong small angle scattering. (auth)

2677

STEEL RESEARCH AND NUCLEAR ENGINEERING. III. L. Dolle. Atomwirtschaft 4, 426-34(1959) Oct. (In German)

Application in nuclear engineering places special requirements on steel and its alloys as on other metals. Above all the changes of structure and properties which take place under irradiation are as decisive as the absorption cross section for neutrons. New problems emerge for steel research in the elucidation of the mechanism of radiation damage and in the quantitative investigation of behavior under the combined action of different conditions of use which must lead to more suitable materials and to technical possibilities for the reduction of radiation damage. At the same time a rapid growth of an entirely new branch of metallurgy is resulting.

2678

AVAILABILITY, PRODUCTION AND CONSUMPTION OF URANIUM. Felice Ippolito (Comitato Nazionale per le Ricerche Nucleari, Rome). Ind. mineraria (Rome) 3p. (1959) Sept. (In Italian)

The known data are reported regarding the world's major producers of uranium oxide, and an analysis is made of future developments bound to be achieved by the state of the market, as compared to the present, temporary, excess of production over consumption. The desirability for Italy to carry out an appropriate research campaign, with a view to assuring the energy supply system of our country and also to fulfilling the obligations taken with the European Atomic Community is emphasized. (auth)

2679

THERMAL CYCLING EQUIPMENT AND ITS EXPERIMEN-

TAL DATA UPON URANIUM. 1. STUDIES ON URANIUM FUEL ELEMENT. K. Taketani (Japan Atomic Energy Research Inst., [Tokyo]). J. Atomic Energy Soc. Japan 1, 190-5(1959). (In Japanese)

Evacuated silica capsules containing uranium specimens made by grooved mill rolling at 600 and 300°C were used for thermal cycling equipment. Cycling was performed between room temperature and 550°C up to 1,000 cycles. The thermal cycling growth coefficients were measured at the three stages. The uranium rod rolled at 300°C was found to have higher thermal cycling growth coefficient than the rod made at 600°C irrespective of the holding time at room and elevated temperature. The effects of rolling temperature of uranium rods on the thermal cycling growth coefficient are described. The specimens after 1,000 cycles were metallographically examined and sub-grains having crystal orientation of 2 or 3 degrees different from each other were observed. (auth)

2680

ON THE PROCESSING METHOD AND PROPERTIES OF ZIRCALOY-2 AND -3. Z. Takao, M. Nishihara, Y. Yagi, and K. Miyamoto (Kobe Steel Works, Ltd., [Japan]). J. Atomic Energy Soc. Japan 1, 240-8(1959). (In Japanese)

A review is presented on the fabrication and melting techniques of Zircaloy-2 and -3. The properties of zirconium–alloyed products are discussed. (C.J.G.)

2681

IMPROVEMENTS IN OR RELATING TO URANIUM ALLOY FUEL ELEMENTS FOR NUCLEAR REACTORS. Roy Alfred Ulfketel Huddle and David Raymon Victor Silvester (to United Kingdom Atomic Energy Authority). British Patent 823,392. Nov. 11, 1959.

Ten U fuel alloys are described and compared with pure U in their oxidizibility by CO_2 at 500°C. The compositions were (in wt. %) 1% Ti, 1% Zr, 3% Zr, 1% V, 1% Nb, 1% Ta, 1% Fe, ½% Cu, 1% Cu, and 1% Zr–0.25% Cu. Pure U was oxidized 3.8 to 6.7 times as much as the alloys. (T.R.H.)

2682

METHOD OF PRODUCING TITANIUM, ZIRCONIUM, AND THORIUM. (to Barium Steel Corp.). British Patent 823,999. Nov. 18, 1959.

A method of preparing pure Ti from oxides and oxide ores, and apparatus for carrying out the procedure is described. The process involves reaction with HF to TiF_4 which reacts with Si to produce SiF_4 and Ti. The SiF_4 can be reacted with H_2O to generate HF for recycling. The first step is carried out in a separate heated vessel batch-wise. A larger vessel is used for the reaction with Si. The TiF_4 is liquid and the Si is finely divided solid. This second reaction should take place at about 1 atm and 600 to 700°F. The upper portion of the vessel is jacketed to condense sublimed TiF_4. (T.R.H.)

2683

PROCESS OF PRODUCING ACTINIDE METALS. T. T. Magel (to U. S. Atomic Energy Commission). U. S. Patent 2,894,832. July 14, 1959.

The preparation of actinide metals in workable, coherent form is described. In general, the objects of the invention are achieved by heating a mixture of an oxide and a halide of an actinide metal such as uranium with an alkali metal on alkaline earth metal reducing agent in the presence of iodine.

2684

METHOD FOR PRODUCING CEMENTED CARBIDE ARTICLES. E. I. Onstott and G. D. Cremer (to U. S. Atomic Energy Commission). U. S. Patent 2,894,837. July 14, 1959.

A method is described for making molded materials of intricate shape where the materials consist of mixtures of one or more hard metal carbides or oxides and matrix metals or binder metals thereof. In one embodiment of the invention 90% of finely comminuted tungsten carbide powder together with finely comminuted cobalt bonding agent is incorporated at 60°C into a slurry with methyl alcohol containing 1.5% paraffin, 3% camphor, 3.5% naphthalene, and 1.8% toluene. The compact is formed by the steps of placing the slurry in a mold at least one surface of which is porous to the fluid organic system, compacting the slurry, removing a portion of the mold from contact with the formed object and heating the formed object to remove the remaining organic matter and to sinter the compact.

2685

METHOD OF ELECTROPOLISHING URANIUM. D. E. Walker and R. A. Noland (to U. S. Atomic Energy Commission). U. S. Patent 2,894,883. July 14, 1959.

A method of electropolishing the surface of uranium articles is presented. The process of this invention is carried out by immersing the uranium article into an electrolyte which contains from 35 to 65% by volume sulfuric acid, 1 to 20% by volume glycerine and 25 to 50% by volume of water. The article is made the anode in the cell and polished by electrolyzing at a voltage of from 10 to 15 volts. Discontinuing the electrolysis by intermittently withdrawing the anode from the electrolyte and removing any polarized film formed therein results in an especially bright surface.

2686

METHOD OF APPLYING NICKEL COATINGS ON URANIUM. A. G. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,894,884. July 14, 1959.

A method is presented for protectively coating uranium which comprises etching the uranium in an aqueous etching solution containing chloride ions, electroplating a coating of nickel on the etched uranium and heating the nickel plated uranium by immersion thereof in a molten bath composed of a material selected from the group consisting of sodium chloride, potassium chloride, lithium chloride, and mixtures thereof, maintained at a temperature of between 700 and 800°C, for a time sufficient to alloy the nickel and uranium and form an integral protective coating of corrosion-resistant uranium-nickel alloy.

2687

PRETREATING THORIUM FOR ELECTROPLATING. J. G. Beach and G. R. Schaer (to U. S. Atomic Energy Commission). U. S. Patent 2,897,124. July 28, 1959.

A method is presented for pretreating a thorium surface prior to electroplating the surface. The pretreatment steps of the invention comprise cleaning by vapor blasting the surface, anodically pickling in a 5 to 15% by volume aqueous hydrochloric acid bath with a current of 125 to 250 amp/sq ft for 3 to 5 min at room temperature, chemically pickling the surface in a 5 to 15% by volume of aqueous sulfuric acid for 3 to 5 min at room temperature, and rinsing the surface with water.

Corrosion

2688 ANL-6053

Argonne National Lab., Lemont, Ill.

CORROSION OF ALUMINUM–URANIUM ALLOYS IN HIGH-TEMPERATURE WATER. W. E. Ruther and J. E.

Draley. Nov. 1959. 9p. Contract W-31-109-eng-38. OTS.

Sixty-day corrosion tests were performed in water at 290°C with unirradiated aluminum–uranium alloys containing 2 wt. % nickel and ½ wt. % iron, with several uranium contents from 15 wt. % to 53 wt. %. The maximum metal penetration rate (4 mils per year by extrapolation) of these alloys was no more than twice that of X8001 aluminum cladding alloy at the same temperature. Preliminary testing in water at 350°C indicated good corrosion resistance for this alloy system up to a maximum of 80 wt. % uranium. (auth)

2689 BMI-1387
Battelle Memorial Inst., Columbus, Ohio.
A VISUAL STUDY OF THE CORROSION OF DEFECTED ZIRCALOY-2-CLAD FUEL SPECIMENS BY HOT WATER. Elmer F. Stephan, Paul D. Miller, and Frederick W. Fink. Oct. 19, 1959. 32p. Contract W-7405-eng-92. OTS.

The failure of defected Zircaloy-2-clad uranium and uranium–2 wt. % zirconium fuel specimens in high-purity high-pressure water at 200 to 345°C was observed in a windowed autoclave. Time-lapse color motion pictures were taken to provide a record of the progressive changes ending in the complete disintegration of the core material in the specimens. Continuous measurement of the pressure increase caused by accumulation of hydrogen served to monitor the progress of the reaction when clouding of the water by corrosion products made visual observation impossible. The nature of the attack of all specimens was similar, although the time at which different stages occurred varied. Following an induction period, the first evidence of attack was the slow formation of a blister in the cladding area surrounding the defect. Eventually, a copious evolution of hydrogen occurred at the base of the swollen area. In general, a crack could be seen in the cladding at this stage. Catastrophic failure of the specimen followed swiftly. The time required for each phase of the reaction was reduced as the temperature was raised. Initial swelling occurred after about 24 min at 345°C but only after 8 hr at 200°C. Diffusion-treated uranium–2 wt. % zirconium-cored specimens were most resistant to attack. Specimens with beta-treated water-quenched natural-uranium cores were least resistant. (auth)

2690 CF-54-9-98
Oak Ridge National Lab., Tenn.
EXAMINATION OF SODIUM, BERYLLIUM, INCONEL PUMP LOOPS, NUMBERS 1 AND 2. G. M. Adamson and E. Long. Sept. 13, 1954. Decl. Oct. 9, 1959. 12p. Contract W-7405-eng-26. OTS.

From data obtained from two loops, the use of beryllium in Inconel systems containing molten sodium appears feasible if the temperature is held below 1200°F. (J.E.D.)

2691 CF-57-2-146
Oak Ridge National Lab., Tenn.
A BRIEF REVIEW OF THERMAL GRADIENT MASS TRANSFER IN SODIUM AND NaK SYSTEMS. J. H. DeVan and J. B. West. Feb. 11, 1957. 19p. Contract [W-7405-eng-26]. OTS.

The fact that material transport does occur under conditions of finite temperature difference in a flowing molten metal system was established. The rate mass transfer was thought to be either diffusion limited or solution rate limited. It is believed that the mass transfer of structural materials in Na or NaK systems is solution rate limited. The limiting process has not been qualitatively or quantitatively confirmed for the Inconel–Na or Inconel–NaK system. Increasing the maximum system wall temperature increases the amount of mass transfer, at least above 1300°F. The effect of the total temperature difference across the system on the amount of mass transfer was determined. (W.L.H.)

2692 CF-57-3-126
Oak Ridge National Lab., Tenn.
COMPATIBILITY TESTS OF VARIOUS MATERIALS IN MOLTEN SODIUM. R. Carlander and E. E. Hoffman. Mar. 25, 1957. Decl. Oct. 9, 1959. 10p. OTS.

Compatibility tests of materials in contact in sodium under 500 psi pressure were conducted for 716 hr at 1500°F. Of the diffusion couples studied, the Inconel–beryllium system showed the largest amount of alloying. The reaction between molybdenum and beryllium resulted in the formation of two compounds, both of which were severely cracked in several areas. The molybdenum–Inor-8 and the Inor-8–type 316 stainless steel interfaces showed little alloying. A compatibility test system was prepared by placing ¼ × ½ × 1 in. specimens of Inconel, beryllium, molybdenum, Inor-8, and type 316 stainless steel together in sodium. (J.E.D.)

2693 CF-59-9-75
Oak Ridge National Lab., Tenn.
TABULAR SUMMARY OF IN-PILE ROCKING AUTOCLAVE SOLUTION CORROSION DATA. R. J. Davis. Sept. 24, 1959. 19p. OTS.

A non-critical tabulation of in-pile rocking autoclave data is presented. Exposure conditions, corrosion data, analytical results, and references to other reports are given. Other data on rocking autoclave experiments can be found in ORNL report CF-58-6-92, June 18, 1958. (auth)

2694 MND-E-2154
Martin Co. Nuclear Div., Baltimore.
AUTOCLAVE TESTING OF INCONEL. NPFO—TASK 1, PHASE 5. J. W. McGrew. Sept. 1959. 17p. Contract DA-44-009-ENG-3581.

Stressed and welded specimens of Inconel were exposed to five severe environmental conditions to test the stress corrosion resistance of the alloy. The experiments were conducted in autoclaves operating at 500°F and 680 psi for 500 hr. The environmental conditions included variations in concentrations of chloride, oxygen, and a method of pH adjustment. The specimens were mounted so that one U-bend specimen was immersed in water and the other was exposed to the steam phase. A weld specimen was placed at the vapor liquid interface. A dull brown adherent coating was formed on all the samples but none of the samples cracked or pitted. The average penetration for all specimens was 0.35 mil/year and the highest penetration for a single specimen was 0.90 mil/year. These low corrosion rates, after due consideration of the environmental conditions, show that Inconel has a high corrosion resistance and might be successfully used in heat exchangers with very little secondary water treatment. (auth)

2695 MSAR-59-99
MSA Research Corp., Callery, Penna.
EFFECT OF 1200 F SODIUM ON AUSTENITIC AND FERRITIC STEELS. Bi-monthly Progress Report No. 1 for July and August 1959 [on] THERMAL SHOCK, NITRIDING, STRESSED CORROSION, UNSTRESSED CORROSION. J. W. Mausteller and R. C. Werner. Sept. 16, 1959. 22p. Contract AT(11-1)-765. OTS.

Completion of preliminary designs for a thermal shock loop, a corrosion loop, and a nitriding loop is reported. Stressed and unstressed corrosion studies are scheduled to be carried out in the same system. A literature search

was started, and various sites were contacted to avoid duplication of effort. It was found that some work has been done at 1200°F sodium temperature with various oxygen concentrations, however part of the data is contradictory. Test plans include corrosion testing of Croloy and stainless steel samples as well as similar and dissimilar welds of these materials in 1200°F sodium. (J.R.D.)

2696 AEC-tr-3876
STUDY OF THE CORROSION OF MONOCRYSTALS OF HIGH PURITY ALUMINUM (99.99%) BY WATER AT ELEVATED TEMPERATURE. P. Lelong and J. Hérenguel. Translated by Myra Scott (Savannah River Lab.) from J. Nuclear Materials 1, 58-72(1959).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15408.

Fabrication

2697 CF-59-10-8
Oak Ridge National Lab., Tenn.
DEVELOPMENT OF SWAGED STAINLESS STEEL FUEL RODS CONTAINING UO_2. J. T. Lamartine and W. C. Thurber. Oct. 12, 1959. 46p. Contract [W-7405-eng-26]. OTS.

Presented at the American Nuclear Society 1959 Winter Meeting, Washington, D. C., November 4, 5, and 6, 1959.

A program was initiated to evaluate rotary swaging as a technique for fabricating stainless steel fuel rods containing UO_2. Emphasis was placed on a parametric study to determine the effects of type of UO_2, total reduction, swaging temperature, and particle size on the swaged density of uranium dioxide in type 304 stainless steel tubing. High-fired, fused and ground, and ceramic-grade oxides were surveyed to determine which materials would swage to the highest density. It was found that fused and ground UO_2 cold swages to the highest density, 91% of theoretical, at a reduction in area of approximately 55%. Rod-milled high-fired UO_2 swages to 85% of theoretical density at a similar reduction. Ceramic grades of UO_2, used for making cold-pressed and sintered pellets, swage to densities less than 75% of theoretical under similar conditions and are considered unsuitable for use in swaged fuel rods. The swageable grades of UO_2 are characterized by high tapped bulk density and low surface area. Oxides having a surface area of less than 0.8 m^2/cm^3 will consistently swage to a density greater than 82% of theoretical. Other observations and data are included. (auth)

2698 DMIC-118
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
WELDING OF HIGH-STRENGTH STEELS FOR AIRCRAFT AND MISSILE APPLICATIONS. H. W. Mishler, R. E. Monroe, and P. J. Rieppel. Oct. 12, 1959. 94p. Contract AF18(600)-1375. (PB-151074). OTS.

Materials and procedures currently being used in the aircraft and missile industry to arc and resistance weld high-strength steels are discussed and summarized. The steels discussed include low-alloy martensitic steels, hot-work die steels, martensitic stainless steels, and precipitation-hardening stainless steels. For each class of steel, welding techniques and procedures are discussed, arc-welding filler materials are described, and mechanical properties of arc and resistance welds are listed. A discussion is included of design, testing, and inspection techniques as applied to weldments made from these high-strength steels. (auth)

2699 KAPL-Spec-KPM-3-49
Knolls Atomic Power Lab., Schenectady, N. Y.
NICKEL–CHROMIUM–IRON ALLOY BARS AND FORGINGS: CORROSION RESISTING, FOR RADIOACTIVE SYSTEM SERVICE. C. F. Barrett, Jr. Sept. 23, 1958. 7p. Contract W-31-109-Eng-52. OTS.

The specification covers the preparation of Ni–Cr–Fe alloy bars and forging of one composition. (W.L.H.)

2700 LAMS-2268
Los Alamos Scientific Lab., N. Mex.
THE ROLLING OF GOLD SHEET FOR THE LAPRE II PRESSURE LINER. R. W. Keil, G. S. Hanks, and J. M. Taub. July 1958. 36p. Contract W-7405-eng-36. OTS.

A special handling procedure devised to prevent contamination of high-purity gold while processing the metal from cast billet to final sheet is discussed. Gold of 99.99% purity was cast into rectangular billets and rolled into a sheet whose final dimensions were 48 by $12\frac{1}{2}$ by 0.015 inch. A procedure for casting, rolling, heat-treatment, cleaning, and inspection of the metal during the course of operations is discussed. Special handling techniques required to maintain the sheet free from surface contamination and imperfections are described. As a final step, the sheet was annealed dead-soft in preparation for subsequent forming operations. (auth)

2701 NMI-4389
Nuclear Metals, Inc., Concord, Mass.
EVALUATION OF ZIRCALOY-CLAD U-2 w/o Zr ALLOY TUBE NO. 36, EXTRUSION NO. 19660. D. F. Kaufman and W. J. Richmond. June 2, 1959. 15p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

A summary of data obtained in the evaluation of Tube No. 36, Extrusion No. 19660 is presented. This tube had heat-treated end seals in comparison with the other three of this group for which the end seals had not been heat treated. The rear end seal would not clean up on the OD after heat treatment so shims were introduced to fill the space. This resulted in a poor rear taper area so the tube should not be irradiated. The tube was processed only through heat treatment. (W.L.H.)

2702 NMI-4396
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period July 1, 1959 through July 31, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, and A. M. Huntress. Oct. 21, 1959. 23p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Post irradiation processing of the five unalloyed extruded U tubes has continued. Experimental work on fabrication of tubes with core alloys of U–1.5 wt. % Mo and U–1 wt. % Si is presented. An extrusion of two additional prototype driver tubes demonstrated the feasibility of extruding this type of tube directly to size without employing cold-drawing. (For preceding period see NMI-4395.) (W.L.H.)

2703 NYO-2792
Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.
A PROGRAM TO STUDY THE FEASIBILITY OF AND DEVELOP AN APPARATUS FOR THE ULTRASONIC ROLL BONDING OF FUEL PLATES. Progress Report for Period June 15–September 30, 1959. R. K. Steele. 36p. Contract AT(30-1)-2379. OTS.

With this is bound: Aeroprojects Inc., West Chester, Penna.
FEASIBILITY STUDY FOR ULTRASONIC ROLL-BONDING OF FLAT PLATE FUEL ELEMENTS. Quarterly Progress

Report No. 1 Covering Period June 16 to September 15, 1959. Contract AT(30-1)-2379, Subcontract No. 1.

A study was made of the feasibility of ultrasonic roll-bond cladding of reactor fuel plates. Exploratory experiments were carried out using the existing roller seam-type welding equipment. A few flat plates fabricated by this procedure were studied to ascertain the requirements for design of equipment to be used in the comprehensive investigations of ultrasonic roll-bond cladding in the course of this program. Improvements in the traversing table ultrasonic roll-bonding machine are being devised. Provision is being made for a range of feed rates, accurate locating and cross indexing of the element, requisite cooling of the sonotrode disk element, and provision is being made for use of an inert atmosphere. Several disk tips are being fabricated to evaluate methods of reducing surface damage to the disk and the fuel plate and for increasing the bond area effected on a single pass. An exploratory program to study the bonding characteristics of the material combinations associated with this project will be carried out with a 4-kw spot-type ultrasonic welder. Power, clamping force, and time-relationships associated with producing bonds with the aluminum and stainless steel claddings to aluminum and stainless steel dispersion cores having varying uranium oxide loadings, will be ascertained. This will excavate problems associated with bonding these material combinations and serve to guide the roll-bonding work. (auth)

2704 ORO-214

Clevite Corp. Mechanical Research Div., Cleveland. MONTHLY PROGRESS LETTER NO. 4 [FOR] PERIOD SEPTEMBER 1, 1959 TO SEPTEMBER 30, 1959. R. Baskey. Oct. 7, 1959. 3p. Contract AT(40-1)-2557. OTS.

A program to develop procedures which utilize Al-coated fuel bearing fiberglas as core material in Al-clad fuel elements is reported. (W.L.H.)

2705 NP-tr-311

EXTRUSION OF STEEL. L. V. Prozorov. Translation of "Vydavlivanie Stali," 1959. 356p. OTS.

A theoretical analysis of metal flow during extrusion is presented along with a review of extrusion research. Extrusion processes and lubricants are recommended and equipment designs are given. (J.R.D.)

2706

ON THE ROLLING OF URANIUM RODS BY GROOVED ROLLS. M. Kawasaki, K. Taketani, Y. Sasaki, and T. Yamamoto (Japan Atomic Energy Research Inst., [Tokyo]). J. Atomic Energy Soc. Japan 1, 19-27(1959) June. (In Japanese)

Some basic studies on the rolling of uranium rods were carried out as a part of preliminary study for the fabrication of natural uranium fuel rod to be used for JRR-3. Two different sequences of groove were adopted; one was the ordinary "Oval-square," and the other was the "Gothic." Because of the underfilled deformation of uranium in the oval groove at 600°C and some operational difficulties, the former sequence seemed to be impractical. On the other hand, the latter sequence was almost satisfactory. The microstructural changes of uranium rod hot rolled at 600 and 500°C, respectively, were also investigated. At 600°C, the recrystallized structure was formed with less rolling reduction than at 500°C, but the size of recrystallized grains after final reduction of 81% in area was finer at 500 than at 600°C. The effects of increasing reduction on hardness of uranium rod at 300 and 600°C as well as on the appearance of uranium rod after final reduction of 45% in area at 300 and 600°C were compared in the respective cases. The dilatation curves of uranium rods for various rolling temperature and degree of reduction as well as its deformation on thermal cycling between 50 and 550°C were discussed. (auth)

2707

ON THE MELTING AND FABRICATION OF ZIRCONIUM AND ZIRCALOY-2. Y. Kondō, S. Suzuki, and M. Furugōri (Sumitomo Metal Ind. Co., Copper Works, [Japan]). J. Atomic Energy Soc. Japan 1, 134-42(1959). (In Japanese)

Experimental studies were carried out on the melting and fabrication of low purity reactor grade zirconium, high purity reactor grade zirconium, Zircaloy-2, and commercial zirconium. Sound ingots were obtained and it was recognized that hot workability (forging and rolling) was good. Effects of cold rolling, annealing temperature, time, atmosphere, and cooling rate on the mechanical properties of the respective materials were discussed and optimum rolling and annealing procedures were established. Recrystallization diagrams are given and grain growth characteristics are compared with those of other materials. It was found that VHN measured at the surface is higher than VHN in the section. The difference was found to increase with cold rolling. (auth)

2708

SOME ASPECT OF THE VACUUM HOT PRESSING OF HIGH GRADE BERYLLIA. K. Kida, M. Abe, S. Nishigaki, and S. Imura (Nippon Gaishi Kaisha, Ltd., [Japan]). J. Atomic Energy Soc. Japan 1, 259-71(1959). (In Japanese)

A method for vacuum hot pressing of high grade beryllia is described. The beryllia was heated by induction for 30 min at 1400°C then subjected to a room pressure of 200 kg/cm^2 in a vacuum of 10^{-3} mm Hg and then pressed into a graphite mold. Properties of the compact are discussed. (C.J.G.)

2709

THE INFLUENCE OF CHROMIUM DIFFUSION UPON THE THERMAL OXIDATION PROPERTIES OF STEEL AND OF NICKEL- AND COBALT-BASE ALLOYS. R. L. Samuel (Diffusion Alloys, Ltd., London) and T. P. Hoar (Univ. of Cambridge, Eng.). Metallurgia 60, 75-80(1959) Sept.

The enrichment with chromium of the surfaces of steels, and nickel- and cobalt-base alloys results in improved oxidation resistance. Even with intrinsically oxidation-resistant materials, the treatment, besides lowering the rate of oxidation, may also alter the nature of the oxidation, which may, in untreated material, proceed in an undesirable manner, such as by intergranular penetration. (auth)

2710

METHOD FOR ANNEALING AND ROLLING ZIRCONIUM-BASE ALLOYS. M. L. Picklesimer (to U. S. Atomic Energy Commission). U. S. Patent 2,894,866. July 14, 1959.

A fabrication procedure is presented for alpha-stabilized zirconium-base alloys, and in particular Zircaloy-2. The alloy is initially worked at a temperature outside the alpha-plus-beta range (810 to 970°), held at a temperature above 970°C for 30 minutes and cooled rapidly. The alloy is then cold-worked to reduce the size at least 20% and annealed at a temperature from 700 to 810°C. This procedure serves both to prevent the formation of stringers and to provide a randomly oriented crystal structure.

2711

JACKETED URANIUM SLUGS AND METHOD. S. H. Paine,

Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,894,889. July 14, 1959.

The patent pertains to a jacketed uranium slug and the process of making the same, involving casting uranium into a molybdenum jacket lined with a bonding layer of nickel.

2712

JACKETING URANIUM. H. A. Saller and J. R. Keeler (to U. S. Atomic Energy Commission). U. S. Patent 2,894,890. July 14, 1959.

The bonding to uranium of sheathing of iron or cobalt, or nickel, or alloys thereof is described. The bonding is accomplished by electro-depositing both surfaces to be joined with a coating of silver and amalgamating or alloying the silver layer with mercury or indium. Then the silver alloy is homogenized by exerting pressure on an assembly of the uranium core and the metal jacket, reducing the area of assembly and heating the assembly to homogenize by diffusion.

2713

PLUTONIUM–URANIUM–TITANIUM ALLOYS. A. S. Coffinberry (to U. S. Atomic Energy Commission). U. S. Patent 2,897,077. July 28, 1959.

A plutonium–uranium alloy suitable for use as the fuel element in a fast breeder reactor is described. The alloy contains from 15 to 60 at.% titanium with the remainder uranium and plutonium in a specific ratio, thereby limiting the undesirable zeta phase and rendering the alloy relatively resistant to corrosion and giving it the essential characteristic of good mechanical workability.

2714

METHOD OF ROLLING URANIUM. C. S. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,897,697. Aug. 4, 1959.

A method is described for rolling uranium metal at relatively low temperatures and under non-oxidizing conditions. The method involves the steps of heating the uranium to 200°C in an oil bath, withdrawing the uranium and permitting the oil to drain so that only a thin protective coating remains and rolling the oil coated uranium at a temperature of 200°C to give about a 15% reduction in thickness at each pass. The operation may be repeated to accomplish about a 90% reduction without edge cracking, checking or any appreciable increase in brittleness.

2715

METHOD OF HEAT-TREATING URANIUM–SILICON ALLOYS. S. T. Zegler (to U. S. Atomic Energy Commission). U. S. Patent 2,898,252. Aug. 4, 1959.

A process is presented for manufacturing uranium alloys of a high degree of dimensional stability and free from thermal expansion. The process involves incorporating 0.01 to 0.1% by weight silicon into uranium, rolling the alloy obtained at a temperature below 660°C, beta-heating the alloy to a temperature of between 660 and 770°C and quenching the alloy.

2716

APPARATUS AND METHOD FOR WELDING END CLOSURE TO CONTAINER. C. E. Frantz and T. B. Correy (to U. S. Atomic Energy Commission). U. S. Patent 2,898,444. Aug. 4, 1959.

A semi-automatic apparatus is described for welding a closure to the open end of a can containing a nuclear fuel slug. An arc is struck at the center of the closure and is shifted to a region near its periphery. Then the assembly of closure, can, and fuel slug is rotated so that the peripheral region of the closure is preheated. Next the arc is shifted to the periphery itself of the closure, and the assembly is rotated so that the closure is welded to the can.

2717

REFRACTORY DIE FOR EXTRUDING URANIUM. E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,899,054. Aug. 11, 1959.

A die is presented for the extrusion of metals, said die being formed of a refractory complex oxide having the composition $M_nO_mR_xO_y$ where M is magnesium, zinc, manganese, or iron, R is aluminum, chromic chromium, ferric iron, or manganic manganese, and m, n, x, and y are whole numbers. Specific examples are spinel, magnesium aluminate, magnetite, magnesioferrite, chromite, and franklinite.

2718

METHOD OF PRODUCING DENSE CONSOLIDATED METALLIC REGULUS. T. T. Magel (to U. S. Atomic Energy Commission). U. S. Patent 2,899,297. Aug. 11, 1959.

A method is presented for reducing dense metal compositions while simultaneously separating impurities from the reduced dense metal and casting the reduced purified dense metal, such as uranium, into well consolidated metal ingots. The reduction is accomplished by heating the dense metallic salt in the presence of a reducing agent, such as an alkali metal or alkaline earth metal in a bomb type reacting chamber, while applying centrifugal force on the reacting materials. Separation of the metal from the impurities is accomplished essentially by the incorporation of a constricted passageway at the vertex of a conical reacting chamber which is in direct communication with a collecting chamber. When a centrifugal force is applied to the molten metal and slag from the reduction in a direction collinear with the axis of the constricted passage, the dense molten metal is forced therethrough while the less dense slag is retained within the reaction chamber, resulting in a simultaneous separation of the reduced molten metal from the slag and a compacting of the reduced metal in a homogeneous mass.

2719

PROCESS OF PRODUCING SHAPED PLUTONIUM. R. J. Anicetti (to U. S. Atomic Energy Commission). U. S. Patent 2,899,298. Aug. 11, 1959.

A process is presented for producing and casting high purity plutonium metal in one step from plutonium tetrafluoride. The process comprises heating a mixture of the plutonium tetrafluoride with calcium while the mixture is in contact with and defined as to shape by a material obtained by firing a mixture consisting of calcium oxide and from 2 to 10% by its weight of calcium fluoride at from 1260 to 1370°C.

Properties and Structure

2720 AECU-4467

Denver. Univ. Denver Research Inst.

STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON–ALUMINUM ALLOYS. Monthly Letter Report No. 7. Frank C. Perkins and Joseph F. Nachman. Nov. 10, 1959. 10p. Contract AT(11-1)-742. OTS.

The objective of the program is to determine the effect of variations of Al content, heat treatment, and basic slip mechanism upon the room temperature ductility of Fe–Al alloys. Additional heat treatment studies on 13.9 Alfenol

tends to confirm earlier observations that reproducibility of ductility values of 8 to 9% are difficult to obtain. The preparation of Al–Y–Fe, and Al–Mo–Y–Fe alloys by arc melting in a non-consumable electrode arc furnace is reported. A resistivity versus temperature curve for the 13.9% Al alloy containing 1% Mo was determined. (W.L.H.)

2721 AECU-4473

Oklahoma State Univ., Stillwater. School of Mechanical Engineering.

STATUS REPORT ON A STUDY OF THE USE OF FURNACE CALORIMETRY FOR THE RAPID DETERMINATION OF SPECIFIC HEAT OF SOLIDS AT HIGH TEMPERATURES. J. H. Boggs and J. A. Wiebelt. Nov. 1959. 9p. Project No. 6. Contract AT(11-1)-71. OTS.

Specific heat values for Mo, Ta, and V at 1500 to 2400°F obtained using an apparatus with automatic control and manual temperature recording are presented graphically. Measurements were attempted at temperatures higher than 2400°, however, materials appear to be a limiting factor in this effort. Measurements at 2600°F were initiated with a ceramic shield around the crucible containing the sample. Two runs with tantalum agree within 3% and further runs are scheduled to establish whether the ceramic shield removed the disturbance factors. It is noted that an uncertainty in heating runs of 3% results in an uncertainty of about ±10% in measurements of specific heat measurements. For preceding period see AECU-4282. (J.R.D.)

2722 ANL-5777

Argonne National Lab., Lemont, Ill.

SOME ASPECTS OF THE BETA TO ALPHA TRANSFORMATION IN URANIUM: METALLOGRAPHIC STRUCTURE AND ORIENTATION RELATIONSHIPS. Work completed: June 1953. H. H. Chiswik and L. T. Lloyd. Nov. 1959. 23p. Contract W-31-109-eng-38. OTS.

A summary is presented of some observations on the effects of cooling rates and temperature gradients during the beta to alpha transformation on substructure and orientation relationships in uranium. (J.E.D.)

2723 ARF-4132-10

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SHOCK IMPINGEMENT EXPERIMENTS ON CRUSHABLE SOLIDS. P. Lieberman. June 1959. 97p. Contract AT(11-1)-528. OTS.

A 2-in. inside diameter shock tube was used to generate strong flat-topped shock waves in argon for impingement against cylindrical specimens of celotex, redwood, and sugar pine up to 6 in. in length. Shock pressures up to 120 atmospheres were induced in the specimens immediately following impingement. Piezoelectric crystal pressure sensors were used to record pressure-time histories in the gas upstream of the gas-solid interface. A method of obtaining points on the shock pressure-specific volume curve (the Hugoniot) for each solid from the experimental data is given. The results for each material are presented graphically, and are compared with isothermal confined static compression data. Rather large volume changes are evidenced in shock at pressures in the neighborhood of the crushing strength for each material. The crushing strength of celotex in shock appears to be well above its confined static crushing strength, and the crushing strengths in shock of redwood and sugar pine appear to be somewhat below the corresponding static crushing strengths. (auth)

2724 BMI-1386

Battelle Memorial Inst., Columbus, Ohio.

THE SOLID SOLUBILITY AND CONSTITUTION OF YTTRIUM IN IRON-20 TO 40 w/o CHROMIUM ALLOYS. Martin S. Farkas and Arthur A. Bauer. Oct. 20, 1959. 22p. Contract W-7405-eng-92. OTS.

The solid solubility of yttrium in iron–20 to 40 wt. % chromium alloys was determined by metallographic techniques and found to be extremely small. At 1320°C, the maximum solubility is about 0.12 wt. % yttrium. Study of iron-rich alloys of the iron–yttrium system shows that the compound YFe_3 exists. A eutectic occurs between iron and YFe_3 at 1257°C. The constitution of iron–20 to 40 wt. % chromium–yttrium alloys containing less than 6 wt. % yttrium was studied between 1250 and 600°C. It was found that, upon exceeding the solubility limit, YFe_3 is formed and occurs in conjunction with alpha iron–chromium. At about 900°C and above 815°C, if more than 6 wt. % yttrium is present in the iron–35 wt. % chromium alloy and more than 3 wt. % in iron–40 wt. % chromium alloy, YFe_4 forms to give a three-phase field of alpha plus YFe_3 plus YFe_4. The upper yttrium limit of this phase field was not determined. At 815°C, sigma phase forms in the iron–chromium system and comes into equilibrium with YFe_3. (auth)

2725 CF-59-7-143

Oak Ridge National Lab., Tenn.

DETERMINATION OF THE NIL-DUCTILITY-TRANSITION TEMPERATURE FOR A212B STEEL USED IN THE N. S. SAVANNAH PRESSURE VESSEL. W. C. Thurber and J. T. Lamartine. July 23, 1959. 26p. Contract [W-7405-eng-26]. OTS.

The nil-ductility-transition (NDT) temperature, as defined by the Naval Research Laboratory drop-weight test, was determined on the A212B carbon-silicon steel used in the pressure vessel of the N. S. Savannah reactor. Correlations were made with the Charpy-V-notch impact energy at NDT. Specimens taken at two different thickness locations from material used in the upper closure head of the reactor vessel yielded NDT temperatures of 0 to 20°F which correspond to Charpy-V-notch impact energies of 11 to 19 ft-lb. Testing of as-received material used in the lower closure head indicated that the NDT temperature was 50°F which was equivalent to an average Charpy-V-notch impact energy of 12 ft-lb. After normalizing and stress-relieving this material, in order to more closely approximate the final condition of the reactor vessel, NDT was reduced to less than 10°F. (auth)

2726 DMIC-Memo-37

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

PROCEDURES FOR THE METALLOGRAPHIC PREPARATION OF BERYLLIUM, TITANIUM, AND REFRACTORY METALS. R. D. Buchheit, C. H. Brady, and G. A. Wheeler. Oct. 26, 1959. 37p.

Basic information for the establishment and practice of satisfactory procedures for the metallographic preparation of refractory metals is presented. The procedures are presented as a compilation of separate discussions for each metal or similar metals and are divided into four major steps: sectioning and mounting, grinding, polishing, and etching. (J.E.D.)

2727 HW-60907

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN X-RAY DIFFRACTION STUDY OF IRRADIATED MOLYBDENUM. D. L. Gray and W. V. Cummings, Jr. July 1, 1959. 19p. Contract W-31-109-Eng-52. OTS.

Changes in the lattice parameter, x-ray line width, and microhardness of commercial molybdenum were observed after irradiation at 35 ± 5°C to various total fast neutron exposures from 6.5×10^{16} to 1.2×10^{20} nvt (neutrons per cm^2). The lattice parameter versus neutron exposure

curve maximizes near 5.0×10^{19} nvt, and at 1.2×10^{20} nvt a net decrease from the pre-irradiation value occurs. Both line width and microhardness increase with neutron exposure and although the microhardness approaches a limiting value with increasing irradiation, the values of line width do not. These effects in irradiated molybdenum are discussed from the standpoint of some recovery reactions which may occur in-reactor during irradiation and it is concluded that interstitial atoms produced by neutron bombardment are mobile at the irradiation temperature, 35°C, during the initial stages of irradiation a substantial number of interstitials become trapped at small substitutional impurity atoms, and interstitial cluster formation and growth predominates during the remainder of the irradiation. Some mechanisms of interstitial cluster formation and growth are discussed. (auth)

2728 IS-26

Ames Lab., Ames, Iowa.

OBSERVATIONS ON CREEP OF TANTALUM. Glenn Murphy and Robert E. Uhrig. Aug. 1959. 29p. Contract W-7405-eng-82. OTS.

At approximately 800°C and 20 psi, the following observations on creep of tantalum were made. The average value of the activation energy (ΔH) for tantalum (determined from four tests) is 109,600 cal/g mole. The average value of the stress parameter for tantalum (determined from four tests) is 5.65×10^{-4} in.^{2}/lb. The value of the stress parameter for tantalum (determined from a plot of the Zener-Holloman parameter vs. stress is 5.81×10^{-4} in.^{2}/lb. The second stage of creep (constant creep rate) lasts only a few hours in tantalum. The third stage of creep (an exponential stage in which the strain and strain rate both vary exponentially with time) was observed. A fourth stage of creep exists immediately prior to failure, in which the creep rate increases more rapidly than the exponential rate in the third stage. The general form of the equation for the creep rate of tantalum in the exponential stage is given. (auth)

2729 NAA-SR-Memo-3730

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

COMPOSITION, BURNUP AND SOME PHYSICAL PROPERTIES OF CERMET FUELS. N. R. Koenig. Apr. 1, 1959. 18p. OTS.

The compounds of U which could be considered as possible dispersions for SGR application are listed along with their densities, U contents, melting points, thermal conductivities, coefficient of thermal expansion, crystal structures, and absorption cross sections as a function of enrichment. Alloys of U under consideration as possible matrices are given along with their melting points, thermal conductivities, densities, cross sections, phase transformations, indicated conversion ratio and U contents in wt. %. The properties of UC and UO_2 dispersions are listed. The data included are cermet densities, U contents, melting points, thermal conductivities, indications of conversion ratio variations, and thermal neutron absorption cross sections. (W.L.H.)

2730 NAA-SR-Memo-3976

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TENSILE PROPERTIES OF ZIRCALOY 2 AT ELEVATED TEMPERATURES. R. K. Wagner. June 5, 1959. 8p. OTS.

The tensile properties of Zircaloy-2 were determined at intermediate and high temperatures. Studies were also made to develop creep data for Zircaloy-2 which would be indicative of the alloy's behavior under moderate loads at 1050°F. (W.L.H.)

2731 NAA-SR-Memo-4269

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE HIGH TEMPERATURE CHEMICAL REACTIVITIES OF THE URANIUM CARBIDES. Louis Silverman. Aug. 19, 1959. 17p. OTS.

The reactions of uranium carbides with elements and compounds are briefly discussed. Phase diagrams of the C–U system are presented. The irradiation properties of uranium carbides are also discussed. (W.L.H.)

2732 NASA-TN-D-121

National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

TENSILE PROPERTIES OF 6A1-4V TITANIUM-ALLOY SHEET UNDER RAPID-HEATING AND CONSTANT-TEMPERATURE CONDITIONS. Howard L. Price. Nov. 1959. 27p. OTS.

Yield strength and rupture strength, obtained from rapid-heating tests, are compared with yield and tensile strengths of elevated-temperature tensile stress-strain tests for ½-hour exposure. Results of some conventional tensile creep tests are presented. A temperature-rate parameter was used to construct master curves from which stresses and temperatures for yield and rupture can be predicted. Yield temperatures under rapid-heating and constant-load conditions at temperature rates from 0.2 to 100°F per second were calculated from phenomenological relation between stress, strain rate, and temperature. (auth)

2733 NP-8044

McDonnell Aircraft Corp., St. Louis.

THERMAL PROPERTIES OF MATERIAL. Report 5926. G. R. Gaumer, D. L. Kummer, and G. Rusert. Feb. 3, 1958. Revised June 18, 1959. 243p.

A compilation of the thermal properties for a number of metallic and non-metallic materials is presented. Included are data on metals, metallic compounds, ceramics, glasses, and plastics. The thermal properties are plotted against temperature and references are given on each graph. (J.R.D.)

2734 NP-8054

Stockholm. Univ. Inst. of Inorganic and Physical Chemistry.

STUDIES ON THE CRYSTAL CHEMISTRY OF TITANIUM, VANADIUM AND MOLYBDENUM OXIDES AT ELEVATED TEMPERATURES. Final Technical Report No. 1 Covering Period October 1, 1958–September 30, 1959. Arne Magnéli, Sten Andersson, Lars Kihlborg, Stig Åsbrink, Sven Westman, Bo Hosmberg, and Claes Nordmark. Oct. 1959. 141p. Contract DA-91-591-EUC-935 OI-1052-59.

The atomic arrangement of the ordered phase Ti_3O occurring within the solubility range of oxygen in α-titanium was determined using single-crystal techniques. The structure is compared with those of Ti_2O and Zr_3O. A study was made of structural and geometrical relations between the δ-titanium oxide and several other phases including α- and β-titanium, the ω-alloy phases, and titanium monoxide. An analysis was performed of the phase relations of the vanadium–oxygen system within the $VO_{0.25}$–$VO_{1.5}$ region at 800°C. A phase of the composition $VO_{0.53}$ (~V_2O) was characterized. The width of the homogeneity range and occupancy of the atomic sites of vanadium monoxide (random, defective NaCl-type) were determined. The phase $VO_{1.27}$ was studied by single-crystal methods. The structure is of a defective NaCl-type containing metal atom

vacancies in an ordered distribution. Accurate atomic coordinates were determined for Ti_2O_3 and V_2O_3 at room temperature and for Ti_2O_3 at ~260°C. The crystal structure of the high-temperature modification of Ti_3O_5 was determined from single-crystal data registered at 175°C. The structure is built up of distorted TiO_6 octahedra, which are joined by sharing edges and corners. A rather short Ti-Ti distance may indicate the presence of a weak bond between pairs of metal atoms. The mechanism of the transition between the two structures is discussed. The crystal structure of V_3O_5 was refined to a considerable degree of accuracy. It is built up of VO_6 octahedra which are joined by sharing faces, edges, and corners. A few mixed oxide phases of V_3O_5 structure was prepared, viz $TiO_2 \cdot V_2O_3$ and $TiO_2 \cdot Cr_2O_3$. General expressions have been derived for structural properties of the homologous series M_nO_{2n-1} (M = Ti, V or (Ti and Cr)). This has made possible the detailed interpretation of the powder patterns of the various homologues of these series. Two unit cell parameters thus obtained are in good agreement with the calculated ones. The phase relations of the MoO_2–MoO_3 region of the molybdenum–oxygen system was investigated within the temperature range 500 to 870°C. The formation conditions were studied for the seven intermediate phases observed. Unit cell dimensions and formulae were derived for the four previously unknown or little known oxides Mo_4O_{11} (monoclinic), $Mo_{17}O_{47}$ (orthorhombic), $MoO_{\sim 2.80}$ (tetragonal), and Mo_9O_{26} (triclinic). Preliminary structures were worked out for the two former compounds. The results are discussed and outlines for future researches are given. (auth)

2735 NP-8102
Cobalt Information Center, Columbus, Ohio.
INFORMATIVE ABSTRACTS ON MAGNETOSTRICTION IN COBALT AND COBALT ALLOYS. Ellis Fletcher. 1959. 60p.

A review of information on magnetostriction, a term used to describe aspects of ferromagnetic material exposure to magnetic fields or stress, is presented. In addition, approximately 110 abstracts and listings on these effects in Co and Co alloys are presented covering the period 1874 to 1959. (J.R.D.)

2736 NRL-5392
Naval Research Lab., Washington, D. C.
HYDROGEN-EMBRITTLEMENT SUSCEPTIBILITY OF SOME STEELS AND NONFERROUS ALLOYS. J. E. Srawley. Oct. 19, 1959. 28p.

A number of steels and nonferrous alloys have been tested to determine their comparative susceptibilities to hydrogen embrittlement. The criterion used was the ratio of the lowest nominal stress at which a hydrogen-charged notched tensile specimen fractured within 100 hr (the "static-fatigue limit") to the notched tensile strength of the uncharged material. Severe conditions of electrolytic charging were used (24 hr at 0.5 amp/in.^{2}) so that a very slight degree of susceptibility might be detected. All steels examined, except cold-rolled AISI type 304 stainless steel, were susceptible in some degree. Hardenable steels harder than Rockwell C-30 were very susceptible, except AISI 1020, which was only moderately susceptible. AISI type 410 stainless was very susceptible at a hardness as low as Rockwell C-21. Of the nonferrous alloys examined, none showed marked susceptibility. It was found that beta brass was susceptible to delayed fracture under constant load, whether charged with hydrogen or not. (auth)

2737 NYO-2547
Rensselaer Polytechnic Inst., Troy, N. Y.
GLASS-CLAD URANIUM GLASS FIBERS FOR POWER REACTORS. PART I. ENGINEERING. Paul Harteck and H. E. Cyphers. July 27, 1959. 55p. Contract AT(30-1)-321, Task 1. OTS.

The advantages and disadvantages of glass-clad uranium glass fibers for use in power reactors are described. These fibers can be manufactured with a range of uranium glass diameters from 0.5 to 250 microns and can be clad with ordinary glass with a clad-thickness range from 0.5 to 50 microns. The uranium in the uranium glass is in the form of U_3O_8 which can be enriched to any desired degree. These fibers are strong and flexible, may be woven into a variety of configurations and sintered together to give a relatively rigid mass. The use of the fibers in organic-cooled and moderated and gas-cooled reactors is discussed. This is a preliminary engineering report. A physics investigation will be the next logical step in ascertaining whether or not the fibers show promise for use in power reactors. (auth)

2738 OOR-2060.1
Brown Univ., Providence.
THE FRACTURE OF BRITTLE AND QUASI-BRITTLE MATERIALS—A SURVEY. J. Gurland. Aug. 1959. 58p. Project No. DA-599-01-004. Contract DA-19-020-ORD-4888.

A survey summarizing some of the prevalent views on the theory, behavior, testing, and design of brittle materials is presented. The survey is concerned first with the absence of plastic deformation and the origin of fracture, and then with a review of the problems of testing and the characteristic features of brittle behavior. (auth)

2739 ORNL-2548
Oak Ridge National Lab., Tenn.
PHASE DIAGRAMS OF NUCLEAR REACTOR MATERIALS. R. E. Thoma, ed. Nov. 20, 1959. 206p. Contract W-7405-eng-26. OTS.

This compilation presents the phase diagrams for possible materials for nuclear reactors developed at the Oak Ridge National Laboratory over the period 1950 to 1959. The systems covered are: metal, metal-fused-salt, fused-salt, oxide, hydroxide, and aqueous. (W.L.H.)

2740 RM-2341(RAND)
RAND Corp., Santa Monica, Calif.
NICKEL, COLUMBIUM, MOLYBDENUM AND TUNGSTEN–A PRELIMINARY STRUCTURAL COMPARISON. George A. Hoffman. Mar. 18, 1959. 27p. (AD-215772).

An illustration of how certain optimum design methods may be used to compare nickel, niobium, molybdenum, and tungsten in applications to structures that are designed by buckling criteria or by simple uniaxial tension is given. The study, based on stress-strain data assumed to represent the best alloys currently available, shows nickel to be superior up to 1300°F and tungsten to be superior beyond 2000°F. (auth)

2741
THE CRYSTAL STRUCTURE OF Ce_2Ni_7. Don T. Cromer and Allen C. Larson (Los Alamos Scientific Lab., N. Mex.). Acta Cryst. 12, 855-9(1959) Nov.

The structure determination of Ce_2Ni_7 is described. The unit cell is hexagonal, probable space group $P6_3/mmc$, with $a = 4.98 \pm 0.02$, $c = 24.52 \pm 0.08$ A, and contains four formula units. The structure consists of double layers of the $CeNi_5$ structure ($CaCu_5$ type) alternating with double layers of the $CeNi_2$ structure (Cu_2Mg type). Relationships between this structure, the $CeNi_3$, and $PuNi_3$ structures, the fundamental MX_5 structure and the three Laves or Friauf phases are discussed in detail. (auth)

2742
THE CRYSTAL STRUCTURE OF Zr_3Al_2. C. G. Wilson,

D. Sams, and T. J. Renouf (Royal Military Coll. of Science, Shrivenham, Berks, Eng.). Acta Cryst. 12, 947-8(1959) Nov.

The crystal structure of Zr_3Al_2 was determined by powder techniques, and the values of $\sin^2\theta$ and observed and calculated intensities are tabulated. The cell dimensions are a = 8.184 ± 0.002 A, c = 5.702 ± 0.002 A, and c/a = 0.697. The calculated density with two units of Zr_3Al_2 in the cell is 5.393 g/cm³. The measured density was 5.61 g/cm³. The space group and atomic positions are given. (L.T.W.)

2743

THE CRYSTAL STRUCTURE OF PuNi. Don T. Cromer and R. B. Roof, Jr. (Los Alamos Scientific Lab., N. Mex.). Acta Cryst. 12, 942-3(1959) Nov.

A single crystal of PuNi was found to be orthorhombic with a = 3.59 ± 0.01, b = 10.21 ± 0.02, and c = 4.22 ± 0.01 A. The following systematic extinctions were observed: hkl absent if h + k = 2n + 1 and h01 absent if l = 2n + 1. These extinctions are characteristic of space groups Cmcm or $Cmc2_1$. Observed and calculated Okl structure factors for PuNi are tabulated. (J.E.D.)

2744

A NEW INTERPRETATION OF THE X-RAY DIFFRACTION PATTERN OF MALLINCKRODT UO_3. David E. Connolly (United Kingdom Atomic Energy Authority, Springfields, Lancs, Eng.). Acta Cryst. 12, 949-51(1959) Nov.

A study of the diffraction pattern of UO_3 revealed several split lines, suggesting a monoclinic or triclinic unit cell. Calculated and x-ray data are tabulated. (J.E.D.)

2745

THE CRYSTAL STRUCTURE OF ZrO_2 AND HfO_2. J. Adam and M. D. Rogers (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Acta Cryst. 12, 951(1959) Nov.

It is indicated that HfO_2 and ZrO_2 are isomorphous and their structure is basically the same as that of the naturally occurring mineral. The unit cell dimensions are tabulated. (J.E.D.)

2746

THE TECHNOLOGY OF ZIRCONIUM AND ITS ALLOYS. PART 2. CORROSION BEHAVIOUR IN CONTACT WITH VARIOUS MEDIA; MECHANICAL PROPERTIES, INCLUDING TENSILE AND IMPACT STRENGTH, CREEP PROPERTIES, AND EFFECTS OF NEUTRON IRRADIATION. D. R. Harries (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chem. & Proc. Eng. 40, 363-8; 378(1959) Oct.

The corrosion behavior of zirconium and its alloys in contact with gases, high-temperature water, steam, and liquid metals is discussed. The mechanical properties, including hardness and tensile and impact strength are reviewed. The results of creep tests on zirconium, zircaloy 2, and zircaloy 3 are given. Neutron irradiation effects on zirconium and its alloys are discussed. (C.J.G.)

2747

MICROSCOPIC AND ELECTRON DIFFRACTION STUDY OF CARBIDATION OF IRON AND ALUMINUM. Jean-Jacques Trillat, Léa Tertian, and Monique Bonnet-Gros (Centre National de la Recherche Scientifique, Paris) Compt. rend. 249, 1299-1302(1959) Oct. 12. (In French)

Microscope and electron diffraction studies are described which led to a more detailed mechanism for the diffusion of solid carbon in iron. Information was obtained on the zones of stability of carbides formed under experimental conditions where the speed of reaction was increased due to the porosity and thinness of composite Al-C films. Decomposition of cementite was also observed. For Al the formation of C_3Al_4 by diffusion of C in Al was shown, at temperatures lower than those generally allowed and for the same reason even higher. (T.R.H.)

2748

MAGNETIC STRUCTURE OF THE ALLOY $MnAu_2$. André Herpin, Pierre Mériel, and Jacques Villain. Compt. rend. 249, 1334-6(1959) Oct. 12. (In French)

A neutron-diffraction study was made of the magnetic structure of $MnAu_2$. All the magnetic moments of atoms in a plane perpendicular to the quaternary axis are parallel and in this plane, and the magnetic moments of atoms of two neighboring planes enclose an angle of 102°. This helicoidal antiferromagnetic structure can be predicted theoretically. (tr-auth)

2749

THE STRUCTURAL MODIFICATIONS OBSERVED BY ELECTRON MICROSCOPE DURING THE ANNEAL OF THIN FOIL OF PURE ALUMINUM EXTENSIVELY COLD-WORKED. Christian Messager and Omourtague Dimitrov. Compt. rend. 249, 1658-60(1959) Oct. 28. (In French)

Aluminum foils, cold-worked by rolling to a reduction degree of 98%, are further reduced in thickness by electrolytic polishing. After rolling the metal has a structure formed of small blocks with dimensions of approximately one micron. If the metal is annealed before the electrolytic polishing, the structure is more perfect. If the sample is annealed after the polishing, the perfecting of the structure is observed, but the anneal temperature must be raised from 120 to 250°C. No enlargement of the blocks were detected in the samples annealed after polishing. For very high purity aluminum, obtained by zone melting, recrystallization occurs in thickness 30 times less than the thickness at which recrystallization occurs in aluminum refined by double electrolysis. (J.S.R.)

2750

THE ESTIMATION OF THE ACTIVITIES IN BINARY LIQUID METALLIC ALLOYS. Étienne Bonnier and Pierre Desré (École Nationale Supérieure d'Électrochimie et d'Électrométallurgie, Grenoble, France). Compt. rend. 249, 1664-6(1959) Oct. 28. (In French)

The methods for the estimation of the activity using the phase diagrams can be made more accurate by the knowledge of the enthalpies of the mixture. The Lumsden theory permits the derivation of a formula using these data. The formula is applied to the liquid systems Na–K, Al–Si, Ag–Bi, and Al–Sn. (tr-auth)

2751

THE STRUCTURE AND ENERGY OF GRAIN BOUNDARIES IN METALS. K. A. Osipov (Baikov Inst. of Metallurgy, Academy of Sciences USSR). Doklady Akad. Nauk S.S.S.R. 128, 284-7(1959) Sept. 11. (In Russian)

An equation derived for a grain boundary symmetrically deflected at small angles $\theta/2$ in relation to two crystals with a simple cubic lattice was used to show that an analogous equation would hold for general boundaries lying between cubic symmetry crystals. The complexity of the boundary and structure of conjugated crystals demands some alterations of separate terms but does not change the appearance of the equation. (R.V.J.)

2752

DIFFUSION AND SOLUBILITY OF TANTALUM IN GERMANIUM. A. V. Sandulova and Khe Iui-lan (L'vov Polytechnic Inst.). Doklady Akad. Nauk S.S.S.R. 128, 329-32(1959) Sept. 11. (In Russian)

The dependence of Ta and Ge diffusion and solubility on specific resistance was investigated. The solubility diagram plotted at various temperatures indicates Ta solubility in n- and p-type Ge at 880 ± 3°. The solubility of the n-type is higher at all investigated temperatures. (R.V.J.)

2753

THE MECHANISM UNDERLYING THE EFFECT OF ALUMINUM ON THE CRYSTALLIZATION OF IRON. D. S. Kamenetskaya, E. P. Rakhmanova, E. Z. Spektor, and V. I. Shiryaev (Central Scientific Research Inst. of Ferrous Metallurgy). Doklady Akad. Nauk S.S.S.R. 128, 924-6 (1959). (In Russian)

The mechanism of the effects of aluminum on the development of crystallization centers was investigated by measuring the supercooling factor in liquid iron with and without admixtures of Al, Al_2O_3, and Fe_2O_3. The experiments show that Al reacts as a surface active soluble admixture which retards crystallization center development. (R.V.J.)

2754

RELATIONSHIP BETWEEN INDENTATION HARDNESS AND NORMAL ELASTICITY MODULUS IN TITANIUM ALLOYS AT HIGH TEMPERATURES. S. G. Fedotov and V. S. Mikheev (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 128, 933-6(1959). (In Russian)

Temperature effects on hardness and normal modulus of elasticity of titanium, 5-component solid solution α titanium with Cr, Fe, Si, and B, and 6-component titanium with variable admixtures of aluminum (3.0, 4.5, 6.0, and 7.5 wt.%) were measured at room temperature to 1000°. The data show that soluble admixtures of B, Cr, Fe, and Si increase the hardness and normal modulus of elasticity of α titanium. Aluminum is the most important element in strengthening the alloys at elevated temperatures. Titanium alloys with variable aluminum admixtures retain their high strength stability up to 500 to 600°, after which a sharp drop in the strength property is observed. The relationship between resistance to plastic deformation and interatomic interactions, estimated by elasticity constants, becomes more pronounced at increased temperatures while the role of structural strengthening factors is diminished. The normal modulus of elasticity and hardness for 5-component α-solution and 6-component alloys with variable aluminum content was plotted at elevated temperatures. (R.V.J.)

2755

THE MECHANISM OF BERYLLIUM EVAPORATION AT A HIGH VACUUM. V. M. Amonenko, L. N. Riabchikov, G. F. Tikhinskii, and V. A. Finkel (Inst. of Physics and Tech., Khar'kov, Ukranian RSR). Doklady Akad. Nauk S.S.S.R. 128, 977-8(1959). (In Russian)

The mechanism of Be vaporization and the source of oxygen in distilled metal are analyzed. Experiments show that Be evaporates from the solid phase in the form of B_2 dimer and from the liquid as Be monomer. The reaction $Be + BeO \rightarrow Be_2O$ takes place at ~1400° and up, with the product Be_2O remaining stable at normal conditions. The lower beryllium oxide has higher volatility than BeO and is one of the sources of oxygen appearing during BeO distillation in the crucible. (R.V.J.)

2756

CHANGES IN THE FINE CRYSTALLINE STRUCTURE IN DECOMPOSITION OF THE Ni–Cr–Al–Ti SATURATED SOLID SOLUTIONS. V. G. Chernyi (Inst. of Metal Physics, Academy of Sciences, Ukrainian RSR). Fiz. Metal. i Metalloved. 8, 66-74(1959). (In Russian)

The fine crystalline structure, changes in crystalline lattice parameters, and hardness of Al–Cr–Ni–Ti alloys after annealing were studied. The conditions of the intermetallic phase during decomposition were analyzed. It is shown that the increase in hardness is not affected by the second type crystalline lattice distortion. (R.V.J.)

2757

PLASTIC PROPERTIES OF BERYLLIUM MONOCRYSTALS. II. R. I. Garber, I. A. Gindin, A. I. Kovalev, and Yu. V. Shubin (Inst. of Physics and Tech., Ukrainian RSR). Fiz. Metal. i Metalloved. 8, 130-9(1959). (In Russian)

Crystallographic and mechanical characteristics of various types of plasticity and decomposition in beryllium monocrystals at −253 to + 800°C were studied. It was revealed that slipping along the (0 0 0 1) plane in the direction of (1 1 2 0) is the basic type of beryllium plastic deformation at −196 to −800°. Erratic shifting along the basic slip band causes microcracking along the second type prism and pyramid planes. (R.V.J.)

2758

STUDIES OF HEAT-CONDUCTING HEAT-RESISTING Cu–Co–Be ALLOYS. M. V. Mal'tsev, V. E. Mikryukov, and Chao Shin-chang (Lomonosov Moscow State Univ.). Fiz. Metal. i Metalloved. 8, 140-6(1959). (In Russian)

The thermal and electric conductivity, the wear and hardness, and the constitution diagram of the Cu–CoBe cross section in Cu–Co–Be alloy were studied. (tr-auth)

2759

PROPERTIES OF TITANIUM ALLOYS. IV. PROPERTIES OF TERNARY Ti–Al–Fe ALLOYS. I. I. Kornilov, E. N. Pylaeva, and M. A. Volkova (Baikov Inst. of Metallurgy). Fiz. Metal. i Metalloved. 8, 182-6(1959) Aug. (In Russian)

The thermal properties of Al–Fe–Ti alloys were studied. The α, β, α + TiFe, $\alpha + \gamma$, and γ phases were found at 1150, 1100, 1000, 800, and 500° in the concentration triangle section adjacent to the titanium angle. Solid solutions of Al and Ti in β titanium occupy considerable area at 1100° while the α-titanium-base ternary solid solutions are distributed as a narrow band along the Ti–Al side. The iron content in the ternary α solid solution is up to 0.5 wt.%. The phase diagram is plotted at 550°. (R.V.J.)

2760

DEFORMATION EFFECTS ON ANNEALED Ni–Cr–Al–Ti ALLOY. V. G. Chernyi (Inst. of Metal Physics Academy of Sciences, Ukranian RSR). Fiz. Metal. i Metalloved. 8, 205-10(1959) Aug. (In Russian)

Effects of plastic deformation on Al–Cr–Ni–Ti alloy (0.59% Al, 19.9% Cr, 2.38% Ti, bal. Ni) were studied in order to determine the state of the intermetallic phase, the fine crystalline structure of the basic solid solution, alterations of the constant crystalline structure during heating, and the hardness. (R.V.J.)

2761

ELECTRON ENERGY SPECTRA OF Fe–Cr AND Fe–Cr–Ni ALLOYS. N. D. Borisov and V. V. Nemoshkalenko (Inst. of Metal Physics, Academy of Sciences, Ukranian RSR). Fiz. Metal. i Metalloved. 8, 211-15(1959) Aug. (In Russian)

Studies were made of the changes in the "outer" elec-

tron energy bands of Fe–Cr during partial replacement of chromium by nickel. (R.V.J.)

2762

EFFECTS OF PLASTIC DEFORMATION ON INTERNAL FRICTION IN IRON AND Fe–Ni ALLOY. R. S. Lebedev and V. S. Postnikov (Kemerovskiĭ State Pedagogical Inst.). Fiz. Metal. i Metalloved. 8, 310-14(1959) Aug. (In Russian)

Effects of plastic deformation (compression of 8, 17, 30, 47, 70, and 92%) on electrolytic iron and 20 to 80% compression on Fe–Ni (4% Ni) internal friction at elevated temperatures were studied. (R.V.J.)

2763

MAGNETIC EFFECTS OF TRANSITION-ELEMENT IMPURITIES IN ALUMINUM. Michael Alan Taylor (Cavendish Lab., Cambridge, Eng.). J. phys. radium 20, 829-30(1959) Oct. (In French)

The effects of small Mn, Cr, and V additions on the magnetic susceptibility of aluminum was studied at 90 to 290°K. The alloys were prepared in a vacuum furnace and were held for 12 hours a few degrees below the fusion temperature. The alloys were then annealed at the eutectic temperature and water tempered. The addition of vanadium decreases the paramagnetism of aluminum independently of temperature. The addition of manganese increases the susceptibility. Chromium also increases it, but less sharply. The numerical results obtained are tabulated. A theoretical study of the magnetic coupling between impurities suggest the existence of antiferromagnetic interaction at a great distance for low concentration of Mn and Cr in Al. The measurement of the Hall effect gave values which coincide with those for pure aluminum. (J.S.R.)

2764

TEMPERATURE EFFECTS ON WEAR RESISTANCE OF ALLOYED AUSTENITE. M. E. Blanter, V. F. Gorshkova, and M. G. Lozenskiĭ (Inst. of Machine Building, Academy of Sciences, USSR). Metalloved. i Termichesk. Obrabotka Metal. No. 7, 2-10(1959) July. (In Russian)

Effects of alloying elements of Cr, Co, Mo, Ni, and W on the wear resistance of alloyed austenite were studied from room temperature to 1100°C. (R.V.J.)

2765

DECOMPOSITION OF STEEL UNDER HYDROGEN ACTION AT HIGH TEMPERATURES AND PRESSURES. N. N. Kolgatin, L. A. Glikman, V. P. Teodorovich, and V. I. Deryabina (All-Union Scientific-Research Inst. of Tech. and Chem Oil Processes). Metalloved. i Termichesk. Obrabotka Metal. No. 7, 16-21(1959) July. (In Russian)

Microscopic studies were made of the influence of hydrogen on the mechanical properties of various steels at 500 and 600°C and high pressures. (R.V.J.)

2766

EFFECTS OF AUSTENIZATION TEMPERATURE AND COOLING IN VIBRATION ANNEALING ON THE QUANTITY OF RESIDUAL AUSTENITE IN ALLOYED STEELS. E. S. Tovpets and F. I. Ivanov (Donets Mfg. Inst.). Metalloved i Termichesk. Obrabotka Metal. No. 7, 50-7(1959) July. (In Russian)

Experiments were conducted for determining the amount of residual austenite produced by vibrational cooling at 830, 900, and 1000° for 45 and 60 min, followed by tempering at 650° for 2 hr and cooling at room temperature. (R.V.J.)

2767

THE SURFACE STRUCTURE OF SILVER CRYSTALS AFTER ARGON-ION BOMBARDMENT. G. J. Ogilvie (Univ. of Melbourne). Phys. and Chem. Solids 10, 222-8 (1959) July

Three single crystals of silver in the form of thin sheets with surfaces parallel to (111), (110), and (100), respectively, have been bombarded with argon ions at several energies in the range 12 to 4000 ev. Electron-diffraction patterns, taken by transmission and reflection, show short arcs and some streaks not present in the diagrams taken before bombardment It has been found that after bombardment the surface contains disoriented crystallites. In general, the crystalline orientations are related to the original orientation by tilts about <112> axes lying in or near the surface of the crystal It is suggested that the bombarding ions can easily penetrate the lattice if directed parallel to close-packed directions and are arrested near dislocation lines giving rise to a high concentration of point defects. These in turn give rise to a net current of interstitial atoms diffusing away from the primary dislocation. This net transfer of material is thought to be the cause of the tilting of lattice blocks. (auth)

2768

MAGNETIC SUSCEPTIBILITY OF THORIUM METAL IN THE RANGE 130–300°K. J. F. Smith and J. D. Greiner (Iowa State Coll., Ames). Phys. Rev. 115, 884-5(1959) Aug. 15.

The magnetic susceptibility of thorium was measured in the temperature range, 130 to 300°K. Within the precision of measurement, the susceptibility was found to remain constant at a value of $+0.410 \pm 0.002$ emu/g. This susceptibility behavior is in contrast to the elastic behavior which indicates a change in the character of the interaction forces near 253°K. (auth)

2769

THE BEHAVIOUR OF HELIUM ATOMS INJECTED INTO BERYLLIUM. R. S. Barnes and G. B. Redding (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 10, 32-5(1959) July.

Disks of extruded and cast beryllium were injected with helium by bombardment with α-particles in a cyclotron. Microscopic observation of the region at the end of the α-particle track shows that the helium contained there precipitates as gas bubbles only if the beryllium is heated to about 800°C, at which temperature the grain boundaries act as sources of the vacancies necessary for the precipitation. Further heating causes the bubbles, which are initially about 4×10^{-6} cm in diameter, to enlarge and to reduce in number resulting in acceleration at the grain boundaries. The large difference in grain size between the extruded and cast beryllium permits a lower temperature of precipitation and more rapid coarsening in the former. (auth)

2770

ON THE THEORY OF X-RAY AND THERMAL NEUTRON SCATTERING BY MULTICOMPONENT SUBSTITUTION ALLOYS. A. A. Smirnov and E. A. (O. O.) Tikhonova (Inst. of Metal Physics, Academy of Sciences, Ukrainian RSR). Ukrain. Fiz. Zhur. 4, 322-33(1959) May–June. (In Ukrainian)

The effect of geometrical distortions of the lattice, connected with the difference of the atomic radii of various components, on the scattering of x rays and thermal neutrons by multicomponent unordered substitution alloys is considered. The model of an elastic continuum is accepted. It is also assumed that the law of displacement superposition holds true, i.e., that the displacement of each atom under the action of all the rest is the vector sum of the

displacements caused by each separate atom. The concentration dependence was investigated, both of the intensity of true reflections and of the intensity of the background in monochromatic ray scattering by a monocrystal. The special cases of binary and ternary alloys are discussed. For binary systems the value of M, which characterizes the weakening of true reflections, depends on the intensity of c_A in accordance with a parabolic law, if the alloy volume is linearly dependent on the concentration. Geometrical distortions of the lattice disturb the parabolic nature of the changes in background intensity with changes in the concentration. If, however, the alloy volume is linearly dependent on the concentration, and the atomic factors of the scattering of atoms A and B are equal, the background intensity again becomes parabolically dependent on the concentration c_A. In the case of ternary alloys, the addition of a third component may—depending on the ratio of the atomic radii and the concentrations of the A, B, and C components—either increase the intensity of the true reflections and decrease the background intensity as compared with the I_{tr}^0 and I_b^0 in binary alloys, or decrease the true reflection intensity and increase the background intensity. The ratios of atomic volumes leading to one or the other result are established. (auth)

2771

ELECTRICAL MIGRATION OF IRON AND ALUMINIUM IN IRON–ALUMINIUM ALLOYS. E. I. Khar'kov and P. P. Kuzmenko (T. G. Shevchenko Kiev State Univ.). Ukrain. Fiz. Zhur. 4, 389-98(1959). (In Ukrainian)

The results of an investigation of the migration of iron and aluminium in Fe–Al alloys with 23, 35, and 40 at. % Al in direct current are presented. The migration of iron in the alloy was studied by applying a radioactive isotope of Fe^{59}; that of aluminium, by the change in weight of the cathode and anode parts of the sample due to the migration of the substance in direct current. A detailed description of the weighing procedure is given. At current densities of 13 to 35 amp/mm^2, aluminium in alloys migrates to the cathode and iron to the anode. The dependence of the volocity of migration V on the temperature T and the current density i was investigated for alloys with 40 at. % Al; the activation energy of the migration process was determined for both components, as well as the dependence of the coefficient of diffusion of iron on the temperature. It was found that at temperatures exceeding 1250°C the migration velocities V_{Fe} and V_{Al} begin to change anomalously, which may be explained by the change in the Fe and Al ions. Investigations of the dependence of the migration velocity on the current density showed that for the interval 13–35 amp/mm^2 this dependence is linear within the limits of experimental error. Hence, it is considered that under the conditions indicated the effect on migration of the "electronic wind" may be neglected in the case of iron–aluminium alloys, and the migration effect may be regarded as the result of the action of the field on atomic residues. Considering that the Einstein ratio, allowing for the coefficient of correlation f, is applicable to metallic systems it was employed to determine the charges of the Fe and Al ions. For an alloy containing 40 at. % of Al, $q_{Fe} = -2.6$, $q_{Al} = +2$ in the temperature region 1000 to 1250°C. In the 1250 to 1340°C range the absolute values of the charges decreases rapidly. It is, thus, shown that considerable ionic coupling occurs in Fe–Al alloys with a high Al content. (auth)

2772

ON THE NATURE OF ATOM ORDERING IN A CADMIUM–TIN SYSTEM. Y. I. Dutchak and N. M. Bondar (Frank L'vov State Univ.). Ukrain. Fiz. Zhur. 4, 402-3(1959). (In Ukrainian)

Data are presented from x-ray-diffraction studies made of cadmium–tin alloy is eutectic composition. (R.V.J.)

2773

VISCOSITY OF ZINC, ALUMINUM, CADMIUM, AND TUNGSTEN MELTS. G. I. Goryaga and I. A. Nosyreva. Vestnik Moskov. Univ. Ser. Mat., Mekhan, Astron., Fiz. i Khim. No. 6, 59-64(1959). (In Russian)

Kinematic viscosities of aluminum, cadmium, tungsten, and zinc melts were measured by torsion vibration of cylindrical crucibles. It was found that the viscosity rises sharply with increased amounts of admixtures and oxides. An approximation formula was developed for the torsion-vibration method of measuring metal viscosity. (R.V.J.)

2774

STRUCTURE OF VAPOR DEPOSITED IRON FILMS AND THEIR OXIDES (INVESTIGATED BY ELECTRON DIFFRACTION). Oswald Haase (Universität, Hamburg). Z. Naturforsch. 14a, 920-2(1959) Oct. (In German)

Iron is deposited from the vapor phase as α iron both oriented and unoriented. On copper surfaces at 350 to 450°C very thin films can be obtained of γ iron, which in thicker foils at equilibrium only exist at 900°. Since copper and γ iron have the same lattice type and the same lattice constants within 2%, the detection of the iron on the copper surface occurs by subsequent oxidation and investigation of the oxide formed. The observed orientation relationships between the γ iron and the oxide formed are explained by the space needs of the oxygen ions which at the beginning of the oxidation process are deposited on the γ iron surface. (tr-auth)

Radiation Effects

2775 AERE-M/R-1434

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EFFECT OF ATOMIC PILE RADIATION ON THE ELASTIC MODULUS OF AN AUSTENITIC STEEL. A. Charlesby, N. H. Hancock, and H. C. Sansom. May 7, 1954. 14p.

A sensitive method was designed for measuring changes in the elastic modulus of a metal during irradiation in an atomic pile. The behavior of "Elinar", an austenitic alloy, was studied at 62 and 70°C over a period of up to eight weeks irradiation in an atomic pile (i.e., for a total integrated flux of 10^{19} neutrons/cm^2). Over a period of three weeks irradiation there was a decrease of less than 0.1% in the elastic modulus of two specimens and about 0.3% in a third specimen. Further irradiation to six weeks restored the elastic modulus to its original value. The change in modulus of the various springs tested is not considered to be statistically significant. (auth)

2776 AFOSR-TR-59-123

Pennsylvania. Univ., Philadelphia.

THE INFLUENCE OF RADIATION INDUCED AND OTHER IMPERFECTIONS ON THE MECHANICAL, THERMAL AND OPTICAL PROPERTIES OF ALKALI HALIDE CRYSTALS. Final Report. B. R. Russell, P. H. Miller, Jr., and M. E. Caspari. July 1959. 57p. Contract AF18(600)-561.

Research is reported on the thermal expansion of LiF single crystals by macroscopic measurements and by x-ray examination of the lattice constant in relation to temperature. The value obtained by the x-ray technique was 6% smaller than the macroscopic value. The difference may be attributed to surface effects of relatively large

magnitude. The generation of point imperfections, and in particular F-centers by weak ionizing irradiation, and the effects of this irradiation on the optical properties and the crystal dimensions, was studied in KCl and NaCl single crystals. A linear relationship was found between the relative linear expansion produced by a certain dose of x-ray irradiation and the F-center concentration produced by that dose. This effect, as well as the slope of this linear relationship, could be interpreted by means of a very simple model. The effect of annealing on the growth of the F-center curve was also determined. A peculiar effect was found in earlier experiments. It appeared that in a partially shielded crystal vacancies are formed upon irradiation even in the shielded portion, indicating that there is some form of energy transfer from the irradiated to the shielded portion. This effect could not be reproduced in later experiments, and it is possible that it exists only in some particular crystals which are no longer available. (auth)

2777 CRMet-864

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE EFFECT OF TEMPERATURE DURING IRRADIATION ON THE BEHAVIOUR OF HELIUM IN BERYLLIUM. C. E. Ells and W. Evans. Oct. 1959. 38p. (AECL-898).

AECL.

Helium has been introduced into specimens of Brush Q.M.V. beryllium by irradiation with alpha particles in the M.I.T. cyclotron. During irradiation, different specimens have been held at a number of different temperatures from ambient to 740°C, respectively. The effect of the helium on the structure of the beryllium has been studied by metallographic techniques. Helium concentrations as low as 0.05 cm^3/cm^3 gave structural effects very easily detected, provided the specimen received a sufficiently severe annealing treatment. Irradiation for 3.5 hr at 605°C to a helium concentration of ≈0.5 cm^3/cm^3 gave no structural effect, whereas irradiation at 740°C gave a marked effect. A helium concentration of ≈0.3 cm^3/cm^3, giving no effect after irradiation at ambient temperatures, nor after an annealing treatment of 118 hours at 600°C, gave an effect after 520 hr at this temperature. Specimens irradiated at ambient temperatures have been annealed at the same elevated temperature at which other specimens were irradiated, with both time at temperature and gas concentrations kept to similar values. For each temperature at which these comparisons were made no marked difference in number or size of gas bubbles was detected. There was however an increased effect at grain boundaries in the case of irradiation at temperature. The results are discussed in terms of second phase particles acting as preferred points of gas bubble nucleation. The results suggest that the neutron-induced gas in the sheaths of beryllium-sheathed fuel elements will not cause catastrophic swelling at an operating temperature of 600°C or lower. (auth)

2778 USNRDL-TR-356

Naval Radiological Defense Lab., San Francisco.

AN X-RAY DIFFRACTION CORRELATION BETWEEN RADIATION DAMAGE AND COMPOSITION OF RUBBER. W. E. Shelberg and L. H. Gevantman. Aug. 12, 1959. 59p.

An x-ray-diffraction technique for measuring radiation damage in rubber was used to correlate radiation damage with rubber composition. The resistances of ten stretched vulcanizates to chain cleaving damage due to cobalt-60 irradiation were compared by the longevities of their crystalline states. The additive, N-cyclohexyl-N'-phenyl-p-phenylenediamine, can significantly mitigate the predominant chain cleaving damage in stretched rubber and the predominant crosslinking reaction in unstretched rubber. Both oxidative and non-oxidative radiation damage may occur in elastomers and the ideal anti-radiation additive should protect against both. (auth)

2779

EFFECTS OF THERMAL TREATMENT ON THE PROPERTIES OF BERYLLIUM OXIDE FRITS OF DIFFERENT DENSITIES IRRADIATED BY NEUTRONS. Jean Elston, Claude Géwiss, and Claude Labbé. Compt. rend. 249, 1635-7(1959) Oct. 28. (In French)

Samples of beryllium oxide frits were exposed to an integrated fast flux of 5×10^{19} n/cm^2. After this irradiation, made at a temperature of the order of 100°C, the length of the samples is increased with the density of the sample. The mechanical properties of the beryllium oxide frits are greatly affected by the irradiation, with the stress rupture dropping approximately 82%. (J.S.R.)

2780

HOW RADIATION AFFECTS SEMICONDUCTOR DEVICES. Michael F. Wolff. Electronics 32, No. 48, 55-7(1959) Nov. 27.

Radiation effects on semiconductors are discussed. Protection can be increased through proper choice of transistors, diodes, and special circuits. The advantages of these devices for semiconductors under neutron and electron bombardment are discussed. (C.J.G.)

2781

THE EFFECTS OF NUCLEAR RADIATION ON MATERIALS. T. P. Flanagan (British Scientific Research Assn., Chislehurst, Kent, Eng.). J. Electronics and Control 6, 337-46(1959) Apr.

The principles underlying the effects of nuclear radiations on materials are outlined. Practical examples are used to illustrate these principles. (C.J.G.)

2782

RADIATION-INDUCED CHANGES IN THE FERROELECTRIC PROPERTIES OF SOME BARIUM TITANATE-TYPE MATERIALS. Issai Lefkowitz (Brookhaven National Lab., Upton, N. Y.). Phys. and Chem. Solids 10, 169-73(1959) July.

Measurements of ceramic $BaTiO_3$ dielectric constant versus temperature as a function of pile irradiation showed modification of the Curie-point transition. In the case of commercially pure ceramic $BaTiO_3$ there was a depression of the dielectric-constant peak with little modification of the room-temperature dielectric constant. Ceramics made with additives showed a shift of the Curie point as well as a depression of the dielectric-constant peak. Material that had been exposed to an integrated pile dosage of 1×10^{18} nvt would not support reversible dielectric polarization. (auth)

2783

WEITERE UNTERSUCHUNGEN UBER RADIOAKTIVE HÖFE UND ANDERE RADIOAKTIVE EINWIRKUNGEN AUF NATURLICHE MINERALIEN. (Further Investigations of the Radioactive Aureoles and Other Radioactive Effects on Natural Minerals). Berlin, Abhandlungen, 1958.

Observations on radioactive aureolas and other changes appearing in ancient conglomerates containing sulfide minerals in addition to uranium minerals are presented. The radioactive effects are classified as radioactive aureolas, formation of isotropic substances due to radioactivity, dislocations due to radioactivity, and chemical changes due to radioactivity. The mechanism of the radia-

tion effect on the crystal lattice was not established. The radioactive aureolas found in many minerals show that they consist of silicates, fluorides, oxides, borates, carbonates, sulfates, and phosphates. Chemical changes in various minerals resulting from radiation are discussed. Discoloration and formation of isotropic substances in minerals such as arsenopyrite, safflorite, löllingite, magnetic pyrites, and graphites, all without ionic bonds, were noted. The changes were caused by powerful radioactive sources, such as uranium pitchblende. In many cases, the lattice pattern was also affected by radioactive sources. Discoloration caused by radioactivity was also noted in some semi-opaque minerals, but only when the radioactive sources were very strong. (TCO)

PHYSICS

General and Miscellaneous

2784 AECU-4377

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

STUDIES OF THE OPTICAL ABSORPTION SPECTRUM OF RUTILE SINGLE CRYSTALS. Technical Report No. 140. Bernard H. Soffer. Aug. 1959. 25p. Contract AT(30-1)-1937. OTS.

The optical absorption of single crystals of synthetic rutile was investigated in the spectral range from 1200 to 25,000 cm^{-1} and from room temperature to 1000°C. The electronic absorption exhibits dichroic behavior. The edge moves toward lower energies as temperature is increased, with the shift depending upon the absorption coefficient; for a decadic absorption coefficient (α') of 400 cm^{-1} the shift is 7.1×10^{-4} ev/°K, while at 1 cm^{-1} it is 9.5×10^{-4} ev/°K. The broad band in the region of 6850 cm^{-1}, which occurs in reduced rutile, does not appear in fully oxidized rutile, even at high temperature. At high temperatures an additional wavelength-independent absorption appears which, by applying the Drude-Zener theory of free carrier absorption, can be correlated with good agreement to d-c conductivity. (auth)

2785 AECU-4482

General Atomic Div., General Dynamics Corp., San Diego, Calif.

EFFECT OF REFLECTORS ON RESONANCE ESCAPE PROBABILITY. J. M. Stein. Dec. 5, 1958. 8p. Project No. 40. (GAMD-610). OTS.

Some procedures now being used for burnup calculations make use of a neutron balance equation as a criticality relation for exploring reactivity during reactor life. This balance makes use of the resonance escape probability calculated for the core composition as an infinite medium as the effective resonance escape probability. Due to neutrons being thermalized in the reflector and being returned to the core, thus avoiding resonance absorption, the effective resonance escape probability and other factors must be modified. The immediate consequence of incorporating the necessary changes to take this effect into account is an increase in life because of a greater production effectiveness of the fuel. The increase in resonance escape probability is calculated in terms of the fast leakage and albedos which define the behavior of the reflector. One of the albedos considered is a conversion albedo which defines the thermalizing properties of the reflector The omission of consideration of this albedo is the origin of the "bare reactor" form of the conventional equations. (auth)

2786 AECU-4492

General Atomic Div., General Dynamics Corp., San Diego, Calif.

REMARKS ON THE USE OF WESTCOTT'S CORRELATION. Bernard Roos. Oct. 10, 1958. 9p. Project No. 40. (GAMD-560; MGCR-R1-21). OTS.

Some elementary arguments are used for deriving an expression for a limit on the C/U atomic ratio below which the Westcott correlation and similar methods might be in error. The whole argument is based upon a homogeneous reactor model. Graphite moderation is assumed throughout. An expression is given for the effective cross section. (W.D.M.)

2787 AERE-M-454

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ONE-GROUP CALCULATIONS OF THE NEUTRON FLUX DISTRIBUTION IN A LATTICE CELL BY CARLSON'S METHOD. R. J. Royston. Aug. 1959. 25p. BIS.

The neutron flux was calculated in various lattice cells by Carlson's S_n method. The SNG program was used in a one-group S_8 approximation. The results were compared with experiment and with other calculations and are in quite good agreement with both. (auth)

2788 AERE-R-3002

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

COLLISION-FREE COMPRESSION OF A PLASMA, USING CHARGED COAXIAL LINES AS AN ENERGY SOURCE. J. H. Adlam and L. C. Pyle. Aug. 1959. 18p. BIS.

Calculations have been made pertaining to the rapid compression of a plasma containing a magnetic field, under conditions such that collisions can be neglected. The compression is obtained by increasing the magnetic field at the surface of the plasma by means of currents flowing in the metallic boundary to the system, which are produced by switching charged coaxial lines. Numerical calculations for such a system show that a disturbance resembling a wave train is propagated into the plasma, and that the voltage across the coaxial line has a roughly sinusoidal time varying component. (auth)

2789 AFOSR-TR-59-769

Ohio State Univ., Columbus.

RESEARCH ON SOLID-STATE PROPERTIES OF METALLIC CERAMIC AND ELECTRONIC MATERIALS. Final Report. P. M. Harris. Sept. 1959. 10p. RF Project 567. Contract AF18(600)-769.

The solid-state properties of lithium, lithium hydride, and silver mercuric iodide were studied. In evaluating the electronic charge density of metallic lithium along the line joining the corner with the body center, it was found that the charge density would never equal the estimate as given by Pauling's theory of directional bonding in metals. For measurements at 300 and 100°K, an effective characteristic temperature, $\theta = 325$°K, was derived. Transformation and phase studies of silver mercuric iodide were studied. The β^1-phase was found to be body-centered tetragonal and $I\bar{4}$ symmetry. Dielectric polarization was noted at low frequencies. A reliability factor for the nonstoichiometric model is 11.5. The Laue-Bragg scattering and the charge distribution in lithium hydride were investigated. (C.J.G.)

2790 APEX-525

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

PARTICLE ESCAPE FROM THE ENDS OF CYLINDRICAL

TUBES. John R. Terrall. Mar. 1958. 35p. Contracts AF33(600)-38062 and AT(11-1)-171. OTS.

The fraction of particles entering a finite cylindrical tube that escape from the tube ends without a collision was studied. It is assumed that the entering angular distribution is a function only of the polar angle measuring deviation from the normal at the entering surface element, that any material in the tube is distributed uniformly, and that the tube has a circular cross section. The theory is discussed from the standpoints of escape from an empty tube, and escape from a nonempty tube. The main discussion centers on the calculation of the escape fraction for those particles entering in the neighborhood of a point on the side surface. (auth)

2791 ARF-1122-13

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

ISOTOPIC SOURCES OF SECONDARY RADIATION. Interim Technical Report No. 2 Covering the Period from March 1 to July 1, 1959. L. Voyvodic. Aug. 3, 1959. 51p. Contract AT(11-1)-657. OTS.

During the past year work carried out in this program has included experiments on the x-ray output produced by separated fission product beta sources, the interpretation of such experiments for the effective design of high level secondary x-ray sources, and the design and testing of prototype sources of secondary radiation for specific industrial applications. An analysis is described which provides an improved basis for evaluating beta excitation of secondary radiation. The results are expressed in a convenient formula for photon yield variations with target thickness, when beta sources are used in sandwich, transmission, and reflection geometries, as well as in mixed source-target configurations. Absolute values of photon yield are similarly derived for bremsstrahlung and characteristic x rays as functions of beta source and target material. Tests are reported on the performance of the initial prototype source design. Observations were made on x rays from conical targets surrounding a "line source" of Kr^{85}. Further design studies are reported on the possible use of Pm^{147} in high level x-ray sources. (W.D.M.)

2792 CERN-59-34

European Organization for Nuclear Research, Geneva.

A SIMPLE METHOD TO ALIGN THE PELLICLES OF A NUCLEAR EMULSION STACK. A. Samman and G. Vanderhaeghe. Oct. 28, 1959. 7p.

A method for following tracks of ionizing particles from one pellicle to another through an emulsion stack is described. By use of this method, the lack of precision inherent to mechanical devices can be avoided as well as that resulting from pellicle deformation. The method is based on the use of negative grids (transparent lines and figures on a black background) printed on stripping films which are handled in such a way that two facing portions of the pellicles have the same grid in exact correspondence printed on them. (J.R.D.)

2793 CRP-851

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

FINITE GEOMETRY CORRECTIONS TO GAMMA-RAY ANGULAR CORRELATIONS MEASURED WITH 5 IN. DIAMETER BY 6 IN. LONG NaI(Tl) CRYSTALS AND WITH 3 IN. DIAMETER BY 3 IN. LONG NaI(Tl) CRYSTALS. A. R. Rutledge. July 1959. 41p.

An addendum to CRP-755, which was concerned with finite geometry corrections to gamma-ray angular correlations measured with 5-in. diam by 4-in. long NaI(Tl) crystals, is presented. Two different crystal sizes are dealt with, and various changes were made in the tables and graphs. (W.D.M.)

2794 ERDL-1581-TR

Army Engineer Research and Development Labs , Fort Belvoir, Va.

RESPONSE OF AN ELASTO-PLASTIC SINGLE DEGREE OF FREEDOM SYSTEM TO AN EXPONENTIALLY DECAYING BLAST WAVE. James W. Maloney. June 23, 1959. 65p.

The complete spectrum of results of an elasto-plastic single degree of freedom system subjected to the classical exponentially decaying blast wave is presented in dimensionless form. The equivalent triangle pulses to g'ive the same maximum displacement and time of maximum response of the rigid plastic system are presented as appendices to the report. (auth)

2795 IDO-16561

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR-ETR TECHNICAL BRANCHES QUARTERLY REPORT [FOR] PERIOD ENDING JUNE 30, 1959. Nov. 10, 1959. 78p. Contract AT(10-1)-205. OTS.

In reactor technical assistance, neutron flux and excess reactivity studies with several different fuel loading patterns were made in the ETR Critical Facility in preparation for major changes to be made in the ETR fuel arrangement to accommodate three additional in-pile loops. On the basis of the studies a loading pattern for ETR Cycle 18 was selected. A new level-safety preamplifier, which increases the sensitivity of the ETR's safety channels significantly, has been designed and tested. The effect of delayed neutrons on results obtained with the pile oscillator has been studied; the ratio of the measured quantity η_5/η_5 (ratio of η for U^{233} to η for U^{235}) to the true quantity is found to vary monotonically downward from 1.0014 when the oscillator cycle time is 10 sec to about 1.0006 for a cycle time of 50 sec. Fuel plate compositions which have been irradiated in the MTR to 65% burnup of the fuel do not reveal in metallurgical examinations any damage as evidenced by dimensional changes, uranium diffusion into cladding, or blistering. Changes in microstructure and matrix hardening are noted. Thermobalance measurements of molten metal–water vapor reactions indicate higher reaction rates for Al-U alloy than for pure aluminum, and curves of reaction rate vs. temperature for both systems apparently exhibit maxima and minima. The Th–U^{233} breeding chain continued to receive major emphasis in the cross section work. Accurate total cross section data for U^{233} and U^{235} in the Maxwellian region are presented. Pa^{231} total cross section measurements have yielded a 2200 m/sec value of 210 ± 20 barns. Eleven resonances were observed below 5 ev, the first occurring at 0.396 ev. A detailed analysis of competitive extinction between planes in crystals of NaCl and Be has revealed that dips in the Bragg beam from the monochromating crystal are an effect of significance in crystal spectrometer measurements. This finding has important implications for reactor spectra determinations. In the nuclear chemistry program, more refined calculations of the reaction products formed in irradiated Be were made. The amounts of reaction products in high burnout irradiations of Th^{232}, U^{233}, U^{235}, U^{236}, U^{238}, Pu^{239}, Pu^{242}, and Cm^{244} have been calculated and a typical yield curve prepared for each nuclide. Large changes in the ratio of asymmetric to symmetric fission mass yields were observed in

Pu^{239} and Pu^{241} for thermal, epi-samarium, and (in the case of Pu^{239}) 0.297 ev monoenergetic neutrons. In the inelastic scattering of slow neutrons program, one rotor of the velocity selector was used as a slow chopper to measure the total cross sections of Ti, V, Y, Ta, and W in the 0.002 to 0.285 ev energy region. These data are presented. Preliminary inelastic scattering measurements were made on NaK, H_2O, and methanol. Directional correlation measurements on the gamma ray cascades following the decay of 45 day Fe-59 have been carried out and results are presented. Studies of spin assignments for levels in Co-59 have not yet produced decisive results. A fast-slow coincidence and pulse-height analyzing system developed for angular correlation measurements has proved successful. Components are all commercial units except for two stages. Effective resolving time achieved so far is about 30 mμsec. Progress has been made in the theory of scattering monoenergetic neutrons by gases, an understanding of which is basic to the more complicated problem of scattering by liquids. Improved programs for the IBM-650, including one for calculation of thermal constants, have been written and checked out to facilitate the work of the Reactor Theory Group. (For preceding period see IDO-16543.) (auth)

2796 KAPL-M-JMS-1

Knolls Atomic Power Lab., Schenectady, N. Y.

CROSS SECTION AND DEPLETION EQUATIONS FOR KARE AND FLAME. J. M. Shinn and D. E. Turcotte, comps. Oct. 26, 1959. 51p. Contract W-31-109-Eng-52. OTS.

Specifications are presented for the cross section and depletion calculations to be included in the few-group neutron diffusion codes KARE and FLAME. KARE is a two-dimensional code for the Philco Transac S-2000, being written at KAPL. FLAME is a three-dimensional code for the Remington-Rand LARC, being written at David Taylor Model Basin. FLAME will also include cross section and depletion calculations specified by Bettis. (W.D.M.)

2797 LAMS-2357

Los Alamos Scientific Lab., N. Mex.

EQUATIONS OF STATE OF LIQUID AND GASEOUS NORMAL HYDROGEN AND THE APPLICATION OF MULTIPLE REGRESSION TECHNIQUES TO CURVE FITTING. R. H. Sherman, R. E. Vogel, R. H. Moore, A. F. Schuch, and A. S. Goldman. Sept. 25, 1959. 32p. Contract W-7405-eng-36. OTS.

Analytical expressions are presented which describe the P-V-T surface of gaseous and liquid normal hydrogen with a precision of 5%. The use of multiple regression techniques for the reduction of experimental data is discussed as well as adaption for use with an IBM-704 computer. (auth)

2798 NAA-SR-Memo-2736

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

GRAPHITE SAMPLE ANALYSIS USING L-47 REACTOR. J. B. Williams. May 2, 1958. 9p. OTS.

Studies were made to determine the feasibility of using the L-47 reactor for routine testing of graphite (for the absorption cross section) to be used in the HNPF core. (W.L.H.)

2799 NP-8024

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

TECHNICAL REPORT 141: SATURATION OF THE MAGNETIC RESONANCE ABSORPTION IN DILUTE INHOMOGENEOUSLY BROADENED SYSTEMS. TECHNICAL REPORT 142: MAGNETIC RESONANCE AND RAPID PASSAGE IN IRRADIATED LiF. James S. Hyde. Oct. 1959. 49p. Contract Nonr-1841(10).

I. Portis proposed a theory of inhomogeneous saturation in which an integration is carried out of the contributions to the magnetic loss by spin packets precessing at a distribution of Larmor frequencies. The shape of the spin packets critically determines the saturation behavior. The theory of Portis is reviewed and a number of criticisms and modifications of the theory are presented. A new theoretical formulation of the problem is then developed, using an expression for the transition probability first given by Rabi. For γH_1 greater than both T_1^{-1} and T_2^{-1}, the r-f field interacts with spins precessing in the frequency interval γH_1; this expression permits explicit calculation of the resulting magnetic loss. No assumption of the shape of the spin packets is made. For F centers in alkali halides the results are identical with those obtained by Portis, but the approaches differ physically, and a situation is discussed where they lead to different predictions. II. The experimental result of Portis, that at room temperature the paramagnetic dispersion signal ($d\chi'_m/dH$) of radiation-induced paramagnetic centers in LiF has the shape of an undifferentiated Gaussian curve and lags the modulation field by 90°, was confirmed. His theory, explaining this result as a manifestation of rapid-passage behavior, was tested over a range of experimental parameters and appears valid. In terms of this theory it was found that the spin-lattice relaxation time $T_1 = 1.5 \times 10^{-4}$ sec at room temperature. Portis predicted that if $\omega_m T_1 \gg 1$, where ω_m is the modulation frequency, the rapid-passage signal should lag the modulation field by 180°. A lag of 130° was found at 4°K in LiF, using a modulation frequency of 23 cps, and the phase appears to approach a constant value. The same phase shift (130°) can be found at room temperature by using 400-cps modulation and can be interpreted as indicating that $T_1 = 2.6 \times 10^{-3}$ sec at 4°K. It seems more likely, however, that at 4°K the assumption made by Portis that $T_2 \gg T_1$ fails, and that spin-spin effects make the situation more complex. An argument is presented that the magnetic resonance arises from the F center. From it's shape a value for the hyperfine splitting, $h\gamma - 32 \pm 1$ gauss, $|\psi(\gamma)|^2 = 3.5 \times 10^{23}$ cm^{-3}, was obtained. This result is compared with those of other workers who have reported resolved structure in LiF, and the conclusion is reached that the resolved structure resonances probably do not arise from the F center. (auth)

2800 NP-8042

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 34. Oct. 15, 1959. 90p. Contract Nonr-1841(34).

Work on the energy bands in iron has led to the conclusion that the charge distribution of the wave functions toward the bottom of the energy band is spread out more than had been previously realized, with the result that this charge would not all be observed in x-ray scattering experiments. More information regarding charge distributions in the transition elements is found in the contribution on atomic scattering factors for these elements and ions. Recently determined Hartree-Fock wave functions of the ions concerned were used to compute atomic scattering factors. Studies on self-trapping in KCl and spin degeneracy were continued. A good deal of progress was made in the digital computer programming of integrals needed for molecular calculations, and in setting up a procedure for

carrying out configuration interaction in molecules. Work was finished on the programming of two-center integrals. Methods of programming various procedures for handling energy bands are discussed. (See also NP-7474.) (W.D.M.)

2801 NP-8049

Connecticut. Univ., Storrs.

FINAL NARRATIVE REPORT AND SUMMARY OF ATOMIC COLLISIONS RESEARCH FOR PERIOD 1953–1959. Report No. 14. E. Everhart, A. Russek, R. J. Carbone, E. N. Fuls, P. R. Jones, F. P. Ziemba, G. Stone, H. Moses, G. Lockwood, G. Morgan, M. T. Thomas, and G. Lane. Sept. 17, 1959. 11p. Project title: A STUDY OF ATOMIC COLLISIONS. Contracts DA-19-059-ORD-1377; DA-19-059-ORD-1899; and DA-19-059-ORD-2710.

Abstracts of OOR Technical Reports 755 : 1 to 755 : 10 are presented along with summaries of papers presented at scientific meetings, and listings of PhD theses and MS theses written in fullfillment of the contract. (auth)

2802 NP-8064

[Akademiia Nauk S.S.S.R. Institut Fiziki im P. N. Lebedeva].

ON COHERENT IMPACT ACCELERATION. V. Veksler and V. Tzytowitch. 1959. 17p.

The coherent impact acceleration is defined as a mechanism in which the peculiarities of collision between bodies moving with relativistic velocities are used for the acceleration of charged particles; the conditions (relations between the dimensions of the bunches, number of particles, etc.) under which the elastic character of collisions will not be disturbed by radiation and consequently very high energies will be transferred to bunches of small mass are determined. The problem of bunch deformation will not be considered and bunch dimensions will be taken as constant. The treatment is for the general case, i.e., the bunches are considered either quasi-neutral or charged. Both bunches are ring-shaped with radius greatly exceeding thickness. The planes of the rings are parallel. The direction of motion of the relativistic ring coincides with that of the ring at rest ν. The light particle currents in both rings are directed along the circumference. The problem is considered in the center-of-mass system. (W.L.H.)

2803 NYO-2604

Air Reduction Sales Co., Inc. Central Research Labs., Murray Hill, N. J.

RESEARCH ON FISSION PRODUCT APPLICATIONS USING GASEOUS BETA SOURCES. Quarterly Progress Report No. 2 for June 1, 1959–August 31, 1959. Hoke S. Miller. Oct. 23, 1959. 14p. Contract AT(30-1)-2343. OTS.

Progress is reported on a study of applications of fission products as gaseous beta sources. Work during the quarter was confined primarily to the use and recovery of krypton-85 of up to one curie levels in tests on the oxidation of hydrogen chloride to chlorine and water. Results indicate it is practical to use krypton-85 in chemical tests and it may be recovered with high efficiency. However, krypton-85 was ineffective under the conditions tested for initiating the oxidation of hydrogen chloride by means of oxygen. (C.H.)

2804 ORNL-2842

Oak Ridge National Lab., Tenn.

NEUTRON PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1959. Nov. 16, 1959. 238p. Contract W-7405-eng-26. OTS.

Research for Light-water-moderated Reactors: Reactivity effects of large voids in the reflector of the Pool Critical Assembly were investigated. The variation of reactivity with void size and position on the core-reflector interface was studied and correlated by a statistical weight correlation. The 32-group, one-dimensional diffusion theory reactor code, GNU-II, and the two-dimensional few-group diffusion theory code, PDQ, both for the IBM-704 computer, were employed for a number of critical mass calculations on 20% U^{235}-enriched and highly enriched pool-type research reactors. Bulk and Tower Shielding Reactors: The fabrication of the stainless steel–UO_2 core (BSR-II) was completed and initial critical tests were performed in the Pool Critical Assembly (PCA). The critical mass of the initial loading was about 5.84 kg of U^{235}. The ratio of the prompt-neutron generation time to the effective delayed-neutron fraction was measured for the BSR-II by the use of the pulsed-neutron method. Fabrication of the Tower Shielding Reactor-II (TSR-II) is nearing completion. Critical Experiments: A series of neutron multiplication measurements with arrays of $1 \times 8 \times 10$ in. slabs of 93.4% U^{235}-enriched U was made to provide data from which safety criteria for the storage of these fissile units can be established. Radial flux measurements with bare gold foils were made in a water-reflected cylindrical annular critical assembly of $U^{235}O_2F_2$–H_2O. A study of some of the critical parameters for water-moderated and -reflected 0.94% U^{235}-enriched annular cylindrical uranium metal slugs is described. Experiments on the poisoning effect of various lattices of copper tubing and rods in aqueous solutions of 93.2% U^{235}-enriched UO_2F_2 having an $H : U^{235}$ atomic ratio of 52.6 were completed. Some data describing the critical conditions of cylindrical volumes of aqueous solutions of U^{235} and U^{233} are presented. Experiments were performed to determine the poisoning effect of Pyrex glass pipe inserted in large vessels containing aqueous solutions of U compounds enriched in U^{235}. Previous studies of the critical parameters of aqueous solutions of 93.2% U^{235}-enriched uranyl fluoride in unreflected cylinders were extended to include solutions with $H : U^{235}$ atomic ratios of 297 and 309. Additional critical experiments were performed with a homogeneous mixture of 2% U^{235}-enriched UF_4 and paraffin, the $H : U^{235}$ atomic ratio for these later experiments being 404. The infinite medium multiplication factor for a homogeneous mixture of 2% U^{235}-enriched UF_4 in paraffin was determined from a series of critical experiments in which known changes in the buckling were made and the resulting stable periods measured. A series of experiments was performed to provide data for the safe handling of 4-in.-diam. by 1-in.-thick 93% U^{235}-enriched U metal buttons and 4-in.-diam. briquettes 2 to 4 in. thick. Fission Physics: Previous measurements of the gamma spectrum closely associated in time with the fission of U^{235} by thermal neutrons were extended down to 10 kev. Critical assemblies of uranyl nitrate solutions of U^{235} and U^{233} in identical spherical geometry were compared to determine the value of η of U^{233} to the value of η of U^{235}. Data from a series of critical experiments utilizing aqueous solutions of U^{235} and U^{233} in 5- and 9-ft-diam. cylinders were analyzed to obtain values of η of U^{235} and η of U^{233}. Absolute values of η for U^{233} and U^{235} were measured directly by a manganese bath technique. A preliminary measurement of the gross spectrum of gamma rays associated with the interaction between thermal neutrons and U^{235} was made, using a three-crystal pair spectrometer and an irradiated U^{235} foil. Experimental Reactor Physics: An experiment to measure the slowing down of U^{235} fission neutrons in water to indium resonance energy was continued. A brief outline of the theory of unreflected reactors is given, and the theory is employed for the analysis of some experimental data obtained at the ORNL Critical Experiments Facility. The variation of the transport mean free path of thermal neutrons in Be

with temperature was investigated by the pulsed-neutron technique. Reactor Theory: The Be(n,2n) reaction produces neutrons which can be used to increase the available reactivity margin in a multiplying assembly. An investigation of the magnitude of this effect was carried out. The theory of the diffusion cooling effect in homogeneous and heterogeneous assemblies is discussed. Theorems are given which permit the estimation of average collision probabilities for convex solids of irregular shape by comparison with solids for which the average collision probability is known. First-flight nonescape probabilities for both a uniform and a persisting neutron distribution in a spherical bare homogeneous reactor were calculated by the second fundamental theorem of reactor theory in order to test its accuracy for small reactors. The influence of the geometric symmetries of a heterogeneous reactor on the flux distribution is discussed. The time behavior of the thermal-neutron energy spectrum of neutrons from a monoenergetic pulsed source in Be assemblies with various geometric bucklings was calculated using the heavy gas model. Two Monte Carlo codes were written to compute the escape probability of neutrons from solids. Several additions were made to the Corn Pone Reactor Code. Neutron thermal cross sections in a medium at a certain temperature may be computed from data taken at a lower temperature. Codes to perform the calculation were written for the IBM-704. A new integral equation governing the slowing down of neutrons in a lump, assuming a spatially uniform neutron flux inside the lump, was derived from the Boltzmann equation. A theoretical calculation, based on a two-group treatment, of the prompt-neutron generation time in the BSR-II was made. The first of a series of calculations of parameters of an unreflected 69.2-cm-diam. critical sphere, based on the use of the consistent P_1 approximation of the Corn Pone Code, was completed. A study of the effects of chemical binding on the scattering of low-energy neutrons in crystals and in fluids is in progress. An IBM-704 code, Slinky, was developed in an attempt to solve the equations of diffusion theory by the Monte Carlo method. Shielding Research: Pulse-height spectra resulting from thermal-neutron-capture gamma rays produced in Al, Pb, and Fe were measured. Predictions of the thermal-neutron fluxes to be expected near the BSR-II were made on the basis of Lid Tank Shielding Facility (LTSF) experimental data transformed to BSR-II geometry. A series of measurements of fast-neutron dose rates, gamma-ray dose rates, and thermal-neutron fluxes in water behind samples of barytes aggregate, barytes aggregate plus portland cement, and barytes concrete was completed at the LTSF. The effective removal cross section of Zr was determined to be 2.36 ± 0.12 barns. The 2π experiments performed by GE at the TSF in 1956 were checked and extended in late 1958 by ORNL. The conditional Monte Carlo method was selected for calculating the deep penetrations of particles through high-energy accelerator shields. A program was initiated to calculate the neutron yields from (α,n) reactions in certain U isotopes (U^{232} through U^{236}), Th^{228} and its daughters, and other elements often present in fabricated U. A calculation method was developed. Radiation Detector Studies: The nonproportionality of response of a 3-in.-diam. by 3-in. NaI(Tl) crystal to gamma rays was studied. A Monte Carlo code was written for the IBM-704 for calculations of the gamma response functions of NaI and xylene scintillation detectors. The gamma response functions of an 8-in.-diam. by 8-in.-long cylindrical NaI(Tl) crystal were investigated experimentally at the BSF. The variation with temperature of the response to monochromatic light of four standard and two modified end-window photomultiplier tubes was investigated over the range from 25 to −195°C for wavelengths from 4000 to 7000A. Previous investigations of the factors influencing the scintillation response of Li^6I and Li^6I(Eu) crystals to gamma rays and to the $(\alpha$-t) pair resulting from slow neutron capture were extended. An investigation is under way at the LTSF to determine the depression of the thermal flux in a medium caused by the presence of a gold foil detector and also to determine other corrections which should be applied to foil measurements. A study was made of the various perturbing factors encountered in the use of foil-activation techniques for measurement of neutron fluxes in water and graphite. Thermonuclear Research: The possibility of causing ions in the DCX to avoid the arc, once trapped, by introducing precession into their orbits was investigated. An IBM-704 code is being designed to solve coupled Fokker-Planck transport equations for the steady-state energy distributions of ions and electrons in DCX. An analysis is presented which indicates the possibility of determining the low electron densities in the DCX plasma from measurements of the Faraday rotation of the polarization plane of microwaves in resonance with the electron cyclotron motion. A complete algebraic analysis was obtained for the variation of the steady-state ion density with injected current in an OGRA-type fusion device. An earlier study of the instabilities of an infinite homogeneous plasma in a uniform magnetic field due to anisotropic velocity distributions suffered from the failure to use the complete set of Maxwell equations. This limited the treatment to longitudinal waves and precluded any consideration of coupling between longitudinal and transverse waves. The work was extended to remedy these defects. A calculation of the cross section for the dissociation of the D_2^+ molecule by a particle of charge Ze was carried out in Born approximation. Theoretical Nuclear Physics: A simple statistical model, in terms of which the general features of the level spacing distribution can be understood, is proposed. It is found that the magnitude of the real part of the optical potential in inelastic scattering, from which distorted waves in direct interactions with nuclei are to be calculated, should be less than that appropriate to elastic scattering. The scattering of fast particles by atomic nuclei for large momentum transfers and small energy loss was studied. Experimental Nuclear Physics: A series of experiments is described in which the energies of the intense gamma rays in the decay of Y^{88}, Zn^{65}, and Mn^{54} were measured, using NaI(Tl) scintillation counters in a variety of geometries and with various combinations of known energy sources. The previously measured cross section for the $Li^6(n,\alpha)H^3$ was re-evaluated in terms of a recent remeasurement of the Np^{237} fission cross section. The Np^{237} fission cross section was measured as a function of neutron energy in the range 0.9 to 8.0 Mev. (For preceding period see ORNL-2609.) (W.D.M.)

2805 SCTM-29-54(51)

Sandia Corp., Albuquerque, N. Mex.

POWER REQUIREMENTS FOR SUSTAINING VIBRATIONS. PART II. D. Maxwell Eliett. Mar. 3, 1954. Changed from OFFICIAL USE ONLY Oct. 30, 1959. 21p. OTS.

A further study is made of the power requirements for keeping various systems in steady state vibration. The case treated is that of a single degree of freedom linear oscillator in which the driving function is movement of the base, the force being transmitted to the mass through the spring and damper. The results of this study are combined with those given in a previous memo (108-53-51) to predict the power requirements for a two degree of freedom sys-

carrying out configuration interaction in molecules. Work was finished on the programming of two-center integrals. Methods of programming various procedures for handling energy bands are discussed. (See also NP-7474.) (W.D.M.)

2801 NP-8049

Connecticut. Univ., Storrs.

FINAL NARRATIVE REPORT AND SUMMARY OF ATOMIC COLLISIONS RESEARCH FOR PERIOD 1953–1959. Report No. 14. E. Everhart, A. Russek, R. J. Carbone, E. N. Fuls, P. R. Jones, F. P. Ziemba, G. Stone, H. Moses, G. Lockwood, G. Morgan, M. T. Thomas, and G. Lane. Sept. 17, 1959. 11p. Project title: A STUDY OF ATOMIC COLLISIONS. Contracts DA-19-059-ORD-1377; DA-19-059-ORD-1899; and DA-19-059-ORD-2710.

Abstracts of OOR Technical Reports 755 : 1 to 755 : 10 are presented along with summaries of papers presented at scientific meetings, and listings of PhD theses and MS theses written in fullfillment of the contract. (auth)

2802 NP-8064

[Akademiia Nauk S.S.S.R. Institut Fiziki im P. N. Lebedeva].

ON COHERENT IMPACT ACCELERATION. V. Veksler and V. Tzytowitch. 1959. 17p.

The coherent impact acceleration is defined as a mechanism in which the peculiarities of collision between bodies moving with relativistic velocities are used for the acceleration of charged particles; the conditions (relations between the dimensions of the bunches, number of particles, etc.) under which the elastic character of collisions will not be disturbed by radiation and consequently very high energies will be transferred to bunches of small mass are determined. The problem of bunch deformation will not be considered and bunch dimensions will be taken as constant. The treatment is for the general case, i.e., the bunches are considered either quasi-neutral or charged. Both bunches are ring-shaped with radius greatly exceeding thickness. The planes of the rings are parallel. The direction of motion of the relativistic ring coincides with that of the ring at rest ν. The light particle currents in both rings are directed along the circumference. The problem is considered in the center-of-mass system. (W.L.H.)

2803 NYO-2604

Air Reduction Sales Co., Inc. Central Research Labs., Murray Hill, N. J.

RESEARCH ON FISSION PRODUCT APPLICATIONS USING GASEOUS BETA SOURCES. Quarterly Progress Report No. 2 for June 1, 1959–August 31, 1959. Hoke S. Miller. Oct. 23, 1959. 14p. Contract AT(30-1)-2343. OTS.

Progress is reported on a study of applications of fission products as gaseous beta sources. Work during the quarter was confined primarily to the use and recovery of krypton-85 of up to one curie levels in tests on the oxidation of hydrogen chloride to chlorine and water. Results indicate it is practical to use krypton-85 in chemical tests and it may be recovered with high efficiency. However, krypton-85 was ineffective under the conditions tested for initiating the oxidation of hydrogen chloride by means of oxygen. (C.H.)

2804 ORNL-2842

Oak Ridge National Lab., Tenn.

NEUTRON PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1959. Nov. 16, 1959. 238p. Contract W-7405-eng-26. OTS.

Research for Light-water-moderated Reactors: Reactivity effects of large voids in the reflector of the Pool Critical Assembly were investigated. The variation of reactivity with void size and position on the core-reflector interface was studied and correlated by a statistical weight correlation. The 32-group, one-dimensional diffusion theory reactor code, GNU-II, and the two-dimensional few-group diffusion theory code, PDQ, both for the IBM-704 computer, were employed for a number of critical mass calculations on 20% U^{235}-enriched and highly enriched pool-type research reactors. Bulk and Tower Shielding Reactors: The fabrication of the stainless steel–UO_2 core (BSR-II) was completed and initial critical tests were performed in the Pool Critical Assembly (PCA). The critical mass of the initial loading was about 5.84 kg of U^{235}. The ratio of the prompt-neutron generation time to the effective delayed-neutron fraction was measured for the BSR-II by the use of the pulsed-neutron method. Fabrication of the Tower Shielding Reactor-II (TSR-II) is nearing completion. Critical Experiments: A series of neutron multiplication measurements with arrays of $1 \times 8 \times 10$ in. slabs of 93.4% U^{235}-enriched U was made to provide data from which safety criteria for the storage of these fissile units can be established. Radial flux measurements with bare gold foils were made in a water-reflected cylindrical annular critical assembly of $U^{235}O_2F_2$–H_2O. A study of some of the critical parameters for water-moderated and -reflected 0.94% U^{235}-enriched annular cylindrical uranium metal slugs is described. Experiments on the poisoning effect of various lattices of copper tubing and rods in aqueous solutions of 93.2% U^{235}-enriched UO_2F_2 having an $H : U^{235}$ atomic ratio of 52.6 were completed. Some data describing the critical conditions of cylindrical volumes of aqueous solutions of U^{235} and U^{233} are presented. Experiments were performed to determine the poisoning effect of Pyrex glass pipe inserted in large vessels containing aqueous solutions of U compounds enriched in U^{235}. Previous studies of the critical parameters of aqueous solutions of 93.2% U^{235}-enriched uranyl fluoride in unreflected cylinders were extended to include solutions with $H : U^{235}$ atomic ratios of 297 and 309. Additional critical experiments were performed with a homogeneous mixture of 2% U^{235}-enriched UF_4 and paraffin, the $H : U^{235}$ atomic ratio for these later experiments being 404. The infinite medium multiplication factor for a homogeneous mixture of 2% U^{235}-enriched UF_4 in paraffin was determined from a series of critical experiments in which known changes in the buckling were made and the resulting stable periods measured. A series of experiments was performed to provide data for the safe handling of 4-in.-diam. by 1-in.-thick 93% U^{235}-enriched U metal buttons and 4-in.-diam. briquettes 2 to 4 in. thick. Fission Physics: Previous measurements of the gamma spectrum closely associated in time with the fission of U^{235} by thermal neutrons were extended down to 10 kev. Critical assemblies of uranyl nitrate solutions of U^{235} and U^{233} in identical spherical geometry were compared to determine the value of η of U^{233} to the value of η of U^{235}. Data from a series of critical experiments utilizing aqueous solutions of U^{235} and U^{233} in 5- and 9-ft-diam. cylinders were analyzed to obtain values of η of U^{235} and η of U^{233}. Absolute values of η for U^{233} and U^{235} were measured directly by a manganese bath technique. A preliminary measurement of the gross spectrum of gamma rays associated with the interaction between thermal neutrons and U^{235} was made, using a three-crystal pair spectrometer and an irradiated U^{235} foil. Experimental Reactor Physics: An experiment to measure the slowing down of U^{235} fission neutrons in water to indium resonance energy was continued. A brief outline of the theory of unreflected reactors is given, and the theory is employed for the analysis of some experimental data obtained at the ORNL Critical Experiments Facility. The variation of the transport mean free path of thermal neutrons in Be

with temperature was investigated by the pulsed-neutron technique. Reactor Theory: The Be(n,2n) reaction produces neutrons which can be used to increase the available reactivity margin in a multiplying assembly. An investigation of the magnitude of this effect was carried out. The theory of the diffusion cooling effect in homogeneous and heterogeneous assemblies is discussed. Theorems are given which permit the estimation of average collision probabilities for convex solids of irregular shape by comparison with solids for which the average collision probability is known. First-flight nonescape probabilities for both a uniform and a persisting neutron distribution in a spherical bare homogeneous reactor were calculated by the second fundamental theorem of reactor theory in order to test its accuracy for small reactors. The influence of the geometric symmetries of a heterogeneous reactor on the flux distribution is discussed. The time behavior of the thermal-neutron energy spectrum of neutrons from a monoenergetic pulsed source in Be assemblies with various geometric bucklings was calculated using the heavy gas model. Two Monte Carlo codes were written to compute the escape probability of neutrons from solids. Several additions were made to the Corn Pone Reactor Code. Neutron thermal cross sections in a medium at a certain temperature may be computed from data taken at a lower temperature. Codes to perform the calculation were written for the IBM-704. A new integral equation governing the slowing down of neutrons in a lump, assuming a spatially uniform neutron flux inside the lump, was derived from the Boltzmann equation. A theoretical calculation, based on a two-group treatment, of the prompt-neutron generation time in the BSR-II was made. The first of a series of calculations of parameters of an unreflected 69.2-cm-diam. critical sphere, based on the use of the consistent P_1 approximation of the Corn Pone Code, was completed. A study of the effects of chemical binding on the scattering of low-energy neutrons in crystals and in fluids is in progress. An IBM-704 code, Slinky, was developed in an attempt to solve the equations of diffusion theory by the Monte Carlo method. Shielding Research: Pulse-height spectra resulting from thermal-neutron-capture gamma rays produced in Al, Pb, and Fe were measured. Predictions of the thermal-neutron fluxes to be expected near the BSR-II were made on the basis of Lid Tank Shielding Facility (LTSF) experimental data transformed to BSR-II geometry. A series of measurements of fast-neutron dose rates, gamma-ray dose rates, and thermal-neutron fluxes in water behind samples of barytes aggregate, barytes aggregate plus portland cement, and barytes concrete was completed at the LTSF. The effective removal cross section of Zr was determined to be 2.36 ± 0.12 barns. The 2π experiments performed by GE at the TSF in 1956 were checked and extended in late 1958 by ORNL. The conditional Monte Carlo method was selected for calculating the deep penetrations of particles through high-energy accelerator shields. A program was initiated to calculate the neutron yields from (α,n) reactions in certain U isotopes (U^{232} through U^{236}), Th^{228} and its daughters, and other elements often present in fabricated U. A calculation method was developed. Radiation Detector Studies: The nonproportionality of response of a 3-in.-diam. by 3-in. NaI(Tl) crystal to gamma rays was studied. A Monte Carlo code was written for the IBM-704 for calculations of the gamma response functions of NaI and xylene scintillation detectors. The gamma response functions of an 8-in.-diam. by 8-in.-long cylindrical NaI(Tl) crystal were investigated experimentally at the BSF. The variation with temperature of the response to monochromatic light of four standard and two modified end-window photomultiplier tubes was investigated over the range from 25 to −195°C for wavelengths from 4000 to 7000A. Previous investigations of the factors influencing the scintillation response of Li^6I and Li^6I(Eu) crystals to gamma rays and to the $(\alpha$-t) pair resulting from slow neutron capture were extended. An investigation is under way at the LTSF to determine the depression of the thermal flux in a medium caused by the presence of a gold foil detector and also to determine other corrections which should be applied to foil measurements. A study was made of the various perturbing factors encountered in the use of foil-activation techniques for measurement of neutron fluxes in water and graphite. Thermonuclear Research: The possibility of causing ions in the DCX to avoid the arc, once trapped, by introducing precession into their orbits was investigated. An IBM-704 code is being designed to solve coupled Fokker-Planck transport equations for the steady-state energy distributions of ions and electrons in DCX. An analysis is presented which indicates the possibility of determining the low electron densities in the DCX plasma from measurements of the Faraday rotation of the polarization plane of microwaves in resonance with the electron cyclotron motion. A complete algebraic analysis was obtained for the variation of the steady-state ion density with injected current in an OGRA-type fusion device. An earlier study of the instabilities of an infinite homogeneous plasma in a uniform magnetic field due to anisotropic velocity distributions suffered from the failure to use the complete set of Maxwell equations. This limited the treatment to longitudinal waves and precluded any consideration of coupling between longitudinal and transverse waves. The work was extended to remedy these defects. A calculation of the cross section for the dissociation of the D_2^+ molecule by a particle of charge Ze was carried out in Born approximation. Theoretical Nuclear Physics: A simple statistical model, in terms of which the general features of the level spacing distribution can be understood, is proposed. It is found that the magnitude of the real part of the optical potential in inelastic scattering, from which distorted waves in direct interactions with nuclei are to be calculated, should be less than that appropriate to elastic scattering. The scattering of fast particles by atomic nuclei for large momentum transfers and small energy loss was studied. Experimental Nuclear Physics: A series of experiments is described in which the energies of the intense gamma rays in the decay of Y^{88}, Zn^{65}, and Mn^{54} were measured, using NaI(Tl) scintillation counters in a variety of geometries and with various combinations of known energy sources. The previously measured cross section for the $Li^6(n,\alpha)H^3$ was re-evaluated in terms of a recent remeasurement of the Np^{237} fission cross section. The Np^{237} fission cross section was measured as a function of neutron energy in the range 0.9 to 8.0 Mev. (For preceding period see ORNL-2609.) (W.D.M.)

2805 SCTM-29-54(51)

Sandia Corp., Albuquerque, N. Mex.

POWER REQUIREMENTS FOR SUSTAINING VIBRATIONS. PART II. D. Maxwell Eliett. Mar. 3, 1954. Changed from OFFICIAL USE ONLY Oct. 30, 1959. 21p. OTS.

A further study is made of the power requirements for keeping various systems in steady state vibration. The case treated is that of a single degree of freedom linear oscillator in which the driving function is movement of the base, the force being transmitted to the mass through the spring and damper. The results of this study are combined with those given in a previous memo (108-53-51) to predict the power requirements for a two degree of freedom sys-

tem similar to the idealized electromagnetic vibration table with a single degree of freedom load. (auth)

2806 UCRL-5612

Stanford Research Inst., Menlo Park, Calif.

A TABLE OF EMISSION LINES IN THE VACUUM ULTRAVIOLET FOR ALL ELEMENTS (6 ANGSTROMS TO 2000 ANGSTROMS). Raymond L. Kelly. [Jan. 1959]. 524p. [For] Univ. of California Lawrence Radiation Lab. OTS.

All the published atomic emission lines contained in the literature up to January 1959, are presented. Each line of data contains the vacuum wavelength in Angstroms, the element and spectroscopic notation for ionization, the intensity, and reference numbers which refer to the list of references at the end of the report. Lists of intense lines arranged by ions, lines arranged by element, and binding lists are included. The intensities given in the tables are those published for spark sources. (W.D.M.)

2807 WAPD-CTA(CE)-87(Rev.); WAPD-CTA(CE)-97; WAPD-CTA(CE)-107

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

STRESSES IN A THICK, FLANGED HEMISPHERICAL SHELL DUE TO INTERNAL PRESSURE. Sept. 4, 1958. STRESSES DUE TO INTERNAL PRESSURE IN A THICK HEMISPHERICAL SHELL ATTACHED TO A LONG CYLINDER. Aug. 25, 1958. STRESSES DUE TO INTERNAL PRESSURE IN A FLANGED SEGMENT OF A SPHERE. Oct. 1, 1958. H. Kraus. 31p. Contract NObs-67500.

Methods for evaluation of stresses acting in flanged hemispherical shells and thick hemispheres attached to long cylinders are presented. In addition, a generalized treatment is presented which extends the method to spherical shells whose angle of opening is less than the 180° opening angle of hemispheres. Walantis codes for stress determination using the IBM 650 are described and sample calculations are included. (J.R.D.)

2808 WAPD-T-918

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

GRAPHICAL SEPARATION OF CRYSTALLITE SIZE FROM STRAIN BROADENING IN X-RAY DIFFRACTION PATTERNS. E. R. Boyko. [1957?]. 8p. Contract AT-11-1-GEN-14. OTS.

A method for separating the crystallite contribution to the x-ray diffraction line broadening from the strain contribution is described. The half width of several reflections $\beta(hkl)$ which were corrected for instrumental broadening by any approximate method may be used. Since there is no demand for accurate data, the approximate method should be useful in dealing with irradiated specimens where the high background makes accurate intensity measurements difficult. Mathematical aspects are discussed and examples of application are given. (J.R.D.)

2809 WAPD-TM-196

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

SPIC-1 — AN IBM-704 CODE TO CALCULATE THE NEUTRON DISTRIBUTION OUTSIDE A RIGHT-CIRCULAR CYLINDRICAL SOURCE. P. Gillis. Nov. 1959. 12p. Contract AT-11-1-GEN-14. OTS.

The SPIC-1 code calculates the fast-neutron dose rate or the thermal neutron flux at a point outside a right circular cylindrical source which is surrounded by cylindrical shell shields and is capped by plane slab shields. The fast neutron attenuation kernel is empirical and is in the form of a linear combination of single exponentials which has been fitted to the experimental fast-neutron dose rate distribution in pure water. Empirical neutron removal cross sections are used to represent the attenuation by shells of non-hydrogeneous materials located in the water. Typical computing and editing time for a 20-field-point-problem, in which there are 10 side and 10 top shields, is 6.5 minutes. The code requires an IBM-704 EDPM with a memory of 32,768 words. (auth)

2810 WAPD-TM-198

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

RECOIL RANGE OF FISSION FRAGMENTS IN ZIRCONIUM. E. R. Smith and P. W. Frank. Nov. 1959. 8p. Contract AT-11-1-GEN-14. OTS.

The recoil ranges of fission fragments in zirconium were measured by irradiating small pieces of a Zircaloy-2 ribbon containing 492 ppm of homogeneously dispersed U^{235}. The samples were wrapped in aluminum foil during the irradiation to catch the fission fragments escaping from the surface of the Zircaloy-2. Average values of 10.1 and 8.15 microns were obtained for the recoil ranges of the median light and heavy fission fragments, respectively; these values compare quite well with values calculated from empirical equations. (auth)

2811 CEA-tr-X-153

MESURE DU FLUX DE NEUTRONS THERMIQUES PAR LA MÉTHODE DE L'ACTIVATION. (Measurement of the Thermal Neutron Flux by the Activation Method). Andras Adam and Istvan Lovas. Translated into French from Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 521-34(1957). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 21094.

2812 NP-tr-308

POSITIVE SURFACE IONIZATION OF SODIUM AND POTASSIUM AND THE PROCESS OF OUTPUT OF ELECTRONS ON THE FACE (110) OF A MONOCRYSTAL OF TUNGSTEN. G. N. Shuppe, Ye. P. Sytaya, and R. M. Kadyrov. SECONDARY ION EMISSION OF MOLYBDENUM DURING ITS BOMBARDMENT BY POSITIVE CESIUM IONS, SPRAYING ON COATINGS OF SODIUM AND POTASSIUM, AND THE ACTION OF OXYGEN. V. I. Veksler and M. B. Ben'yaminovich. Translated from Trudy Sredneaziat. Gosudarst. Univ. im. V. I. Lenina, Fiz. Mat. Nauki 91, 5-15; 57-66(1957). 41p. OTS.

Data from surface ionization measurements of K and Na crystals are presented. The magnitude of electron output from the 110 surface of tungsten crystals is also examined. In addition, the ion emission of Mo during bombardment with Ce ions is discussed along with the effects coating the Mo with Na and K, and the effects of oxygen on the reaction. (J.R.D.)

2813 NP-tr-310

PHOTOPLASTICITY. S. I. Gubkin, S. I. Dobrovol'skii (Dobrovol'sky), and B. B. Boyko. Translation of "Fotoplastichnost," 1957. 194p. OTS.

An experimental method is described for studying the processes of plastic deformation and stresses by translucence in polarized light of optically sensitive, permanently deformed materials. The emphasis in this presentation is on viscous flow, and results may be used in studying models of various deformation processes. (J.R.D.)

2814

MAGNETIC FIELD STABILIZER BASED ON NUCLEAR MAGNETIC RESONANCE. M. Drághichescu and I. Pascaru. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 358-60(1959). (In Rumanian)

The design and performance of a magnetic field stabilizer, based on the indication of proton absorption in the lessening of spin-lattice relaxation of $Fe(NO_3)_3$ dissolved in water are described. A block diagram of the stabilizer is given. (J.S.R.)

2815

THE CRYSTAL STRUCTURE OF AMMONIA MONOHYDRATE. Ivar Olovsson and David H. Templeton (Univ. of California, Berkeley). Acta Cryst. 12, 827-32(1959) Nov.

The crystal structure of ammonia monohydrate, $NH_3 \cdot H_2O$, has been determined from three-dimensional x-ray data. Exposures at –95 and –160°C indicate the same structure. The crystals are orthorhombic (space group $P2_12_12_1$) with four molecules in a unit cell of dimensions: a = 4.51 ± 0.01, b = 5.587 ± 0.003, c = 9.700 ± 0.005 A at –160°C. The structure contains planar chains of water molecules connected by hydrogen bonds of 2.76 A. The chains are crosslinked by the ammonia molecules into a three-dimensional network by short bonds (2.78 A) of the type O—H···N and long bonds (3.21, 3.26, 3.29 A) of the type O···H—N. (auth)

2816

X-RAY STUDY OF SOLID AMMONIA. Ivar Olovsson and David H. Templeton (Univ. of California, Berkeley). Acta Cryst. 12, 832-6(1959) Nov.

Ammonia and deutero-ammonia have been studied by single-crystal and powder x-ray methods. There are four molecules in the cubic unit cell, and the space group is confirmed to be $P2_13$. The nitrogen parameter obtained by least-squares refinement is equal to 0.0401 for NH_3 at –102°C and the same for ND_3 at –160°C. Cell dimensions, determined by powder methods, are: a = 5.084 A for NH_3 at –196°C, 5.073 A for ND_3 at –196°C, 5.091 A for ND_3 at –160°C, and 5.138 A for NH_3 at –102°C. Each ammonia molecule is involved in six hydrogen bonds of approximate length 3.4 A. A possible assignment of the hydrogen atoms to these bonds is given. Electron-density maps give evidence of hydrogen positions with coordinates (0.85, 0.14, 0.99), in agreement with this assignment, but with hydrogen off the bond axis, making the H—N—H angles more nearly tetrahedral. (auth)

2817

RARE EARTH ION RADII IN THE IRON GARNETS. S. Geller and D. W. Mitchell (Bell Telephone Labs., Murray Hill, N. J.). Acta Cryst. 12, 936(1959) Nov.

The iron garnets of the trivalent ions of Sm, Eu, Gd, and Y were prepared and the lattice constants were measured. (J.E.D.)

2818

ON THE THEORY OF LIQUID AND SOLID He^3. Louis Goldstein (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N. Y.) 8, 390-434(1959) Nov.

Several features of the theory of the nuclear spin system in liquid and solid He^3 are developed quantitatively. The effect of the application of external pressure on the spin system is described. The attempt to correlate the various experimentally determined thermal properties of the compressed liquid from the standpoint of the theory of the spin system leads to the need of new and precise nuclear paramagnetic susceptibility measurements in order to verify various predictions of the theory. One concerns the strictly asymptotic temperature approach of the nuclear paramagnetic susceptibility of the liquid, or the solid, toward its limiting ideal Langevin-Brillouin limit. This feature of the susceptibility appears to be necessary for an explanation of the locus of the vanishing expansion coefficients located, at already moderate pressures, at relatively high temperatures, $T \gtrsim 1.0°K$. On assuming the absence of nuclear magnetic anomalies, the spin system of the solid is expected to render this phase also anomalous in its thermal properties, up to relatively high temperatures and pressures, as suggested by recent findings. Within certain relatively mild limitations, it is shown that solid He^3 may exhibit two possible types of thermal excitations of its normal degrees of freedom. One case corresponds to excitations which appear to be particle like, as those of the liquid all over its phase diagram. They impose at low temperatures negative latent heats in the solid-liquid phase change, through the dominance of the entropy decrease of the nuclear spin system in this transformation. In the other case, phonon types of thermal excitations appear to be allowed, provided the solid-liquid phase separation line has a positive though small temperature slope at low temperatures. (auth)

2819

THE PHOTOELECTRIC EFFECT AT HIGH ENERGIES. Thomas Erber (Illinois Inst. of Tech., Chicago). Ann. Phys. (N. Y.) 8, 435-72(1959) Nov.

The total cross section for the photoejection of a 1s electron is calculated in the limit of high energies. Although initial and final states are both represented by the exact Dirac wave functions, it is possible to carry out all operations, except the last, in closed form. The final integral is evaluated by approximate analytical techniques as well as by machine calculation. The results are not in quantitative agreement with previous work. Symmetries of the high-energy matrix elements permit an immediate extension of the discussion to bound-pair production (annihilation) and capture-bremsstrahlung. (auth)

2820

SHOCK WAVE IN A PLASTIC MEDIUM OF VARIABLE DENSITY. E. I. Andriankin and V. P Koryavov (Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 128, 257-60(1959) Sept. 11. (In Russian)

An analysis is made of the problem of spherically symmetric blast in a medium where the density of the shock wave depends on the pressure and the medium behind the shock wave is plastic (the Prandtl plasticity condition is fulfilled) and incompressible (the particle density is conserved). (R.V.J.)

2821

ON THE MAGNETIC FLUX FUNCTION IN A THREE-DIMENSIONAL FIELD. V. I. Skobelkin (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 128, 280-3(1959) Sept. 11. (In Russian)

In general the tridimensional field is described by two continuous functions of magnetic flux ψ and θ which are connected with the magnetic induction B by the relation $B = \nabla\psi \times \nabla\theta$. ψ = const and θ = const constitute magnetic field surfaces; the intersections of any ψ and θ surfaces form the field power lines; the product $(\psi_1 - \psi_2)(\theta_1 - \theta_2)$ determines the magnetic flux in the areas limited by the surfaces ψ_1, ψ_2, θ_1, and θ_2. The functions of ψ and θ are used for writing the lagrangian for a tridimensional field which substantiates the previously postulated variation principle for the approximate solution of boundary problems for plane and axial symmetric ferromagnetic systems in current fields. The magnetic flux vector $R = \frac{1}{2c}(\psi\nabla\theta - \theta\nabla\psi)$ and the flux potential density function $u = jR$, where j is the current density vector, are introduced in the lagrangian. When $W = \int^{B} H dB$ designates the magnetic field energy density, then the lagrangian is $L = W + u$. The

principle was formulated as follows: Among all possible solenoidal magnetic induction fields with fixed boundary conditions fulfilled, for the effective field of closed magneto-static systems the space integral $E = \int Ldw$ is of the smallest magnitude. (R.V.J.)

2822

EFFECT OF PLUTONIUM ACCUMULATION ON NEUTRON SPECTRUM. M. Kitazume, T. Kawai, and K. Hasegawa. J. Atomic Energy Soc. Japan 1, 249-58(1959). (In Japanese)

Wigner-Wilkins have analytically calculated the neutron spectrum in an infinitely large monatomic hydrogen gas moderator in which the absorption cross section has the usual inverse dependence on velocity, v. The above analytical methods were found to be not always applicable. A calculation is given for the neutron spectum in a monatomic hydrogen gas moderator which contains hypothetically a large amount of Pu^{239} absorber or 1/v law dependent absorber. The calculation is based on the assumptions that the temperature of the moderator T = 581°K, the scattering cross section of hydrogen is constant (50 barn), and the ratio of the number of atoms of Pu^{239} or 1/v law absorber to the hydrogen atoms are 0, 0.01, and 0.02. When the moderator contains no Pu^{239}, the distribution of the neutron velocities is approximately Maxwellian. However, when the concentration is 0.01 or 0.02, the spectrum is shifted in the direction of higher energies, i.e., the spectrum is hardened. There is a pronounced dip at the 0.3 ev resonance of Pu^{239}. In the case of the 1/v law absorber, the distribution is Wigner-Wilkins spectrum and the spectrum is shifted in the direction of higher energies. (auth)

2823

CALCULATION OF ELECTRON-BEAM DIVERGENCE AT MEDIUM GAS PRESSURES. B. H. Wadia (Central Electronics Engineering Research Inst., Pilani, Rajasthan, India). J. Electronics and Control 6, 307-20(1959) Apr.

In the calculation of the divergence of long electron beams, perfect vacuum conditions are generally assumed to exist. However, in all practical cases, the presence of gas within the tube cannot be avoided; its effect is to reduce the dispersive forces on the beam. Because of the large number of variables involved, the effect of gas on beam divergence has not thus far been susceptible to analytic solution; however, a numerical approach based on the use of universal curves and step-by-step integration is found to be capable of giving a reasonable estimate of the beam profile in the presence of gas. Three examples of electron beams of various pervences and entrance angles are solved using this method over a range of pressures from perfect vacuum to full neutralization. A study of these cases enables us to give a rational picture of the behavior of electron streams in the presence of gas and several interesting conclusions are drawn regarding the position of the minimum, cross-over, and the condition for parallel beam. Indications are that pressures better than 10^{-8} mm Hg are required before one can truly assume perfect vacuum conditions to prevail. (auth)

2824

APPLICATION OF LOW-SENSITIVITY EMULSIONS TO THE DISCRIMINATION OF HEAVY IONS. Ch. Gegauff and J. P. Lonchamp (Laboratorie de Physique Corpusculaire, Strasbourg). J. phys. radium 20, 797-803(1959) Oct. (In French)

A review of all the experimental facts showing that heavy ion tracks in nuclear emulsions are formed of two distinct parts called "primary" and "secondary" is presented. The determination of the specific energy loss of the "primary part" of the track suggests a method of identification of heavy ions (Z = 6, 7, 8, 10, and 18) recorded in low-sensitivity emulsions (Ilford K_0, K—1, K—2). Several means of identification are discussed as length without gaps at the end of the track and number of gaps counted from the end of the track. It is possible to identify the ions with an accuracy of one unit of charge. (auth)

2825

EFFECTS OF CONTINUOUS AND ALTERNATING ELECTRIC FIELDS ON THE LUMINESCENCE OF SOME ZINC SULFIDES EXCITED BY α RADIATION. A. Coche and R. Henck (Laboratorie de Cme Chimie Nucléaire, Strasbourg). J. phys. radium 20, 827-8(1959) Oct. (In French)

The effects of alternating and continuous electric fields on the luminescence of mixed sulfides of zinc and cadmium, activated by manganese, were studied. The results showed that the application of an alternating voltage, lower than the electroluminescence threshold, to the scintillators excited by alpha radiation causes a variation of the intensity of emitted light, which is characteristic for each scintillator. The variation of the coefficient of amplification was determined as a function of applied voltage for the yellow and blue luminescent bands. Lasting modifications of the luminescence resulted from the continuous field. A memory effect, connected both with the alternating field and the continuous field was found. The effects of a continuous field to a scintillator in the absence of excitation by alpha radiation were also investigated. (J.S.R.)

2826

DIFFUSION COEFFICIENTS OF GASES FROM THE RATE OF APPROACH TO THE STEADY STATE IN THERMAL DIFFUSION. S. C. Saxena and E. A. Mason (Univ. of Maryland, College Park). Mol. Phys. 2, 264-70(1959) July.

The rate of approach to the steady state in a convection-free two-bulb thermal diffusion experiment is treated in a more rigorous manner than previously available, in order that reliable ordinary diffusion coefficients may be derived from thermal diffusion measurements. The final results are of the same form as in the original simplified Jones and Furry treatment, but the parameters are now interpreted somewhat differently and a new correction term appears. Application to Nettley's measurements on H_2-N_2 mixtures removes an apparent discrepancy with the kinetic theory prediction of the composition dependence of the diffusion coefficient for this system. (auth)

2827

FLUCTUATIONS IN PHOTON STREAMS. Peter Fellgett (Univ. of Cambridge, Eng.); R. Clark Jones (Polaroid Corp., Cambridge, Mass.); and R. Q. Twiss (Univ. of Sydney). Nature 184, 967-9(1959) Sept. 26.

A review is given the fluctuation formulas derived by Jones and Fellgett, and by Hanbury Brown and Twiss. The two formulas were reconciled and each is shown to be correct in the circumstances for which they were originally derived. (C.J.G.)

2828

X-RAY AND NEUTRON SCATTERING FROM ELECTRONS IN A CRYSTALLINE FIELD AND THE DETERMINATION OF OUTER ELECTRON CONFIGURATIONS IN IRON AND NICKEL. R. J. Weiss and A. J. Freeman (Watertown Arsenal, Mass.). Phys. and Chem. Solids 10, 147-61(1959) July.

The effect of nonspherical charge distributions on x-ray and neutron scattering factors has been calculated for d- and f-electrons in cubic, tetrahedral, and hexagonal

crystalline fields. The theory indicates that large deviations from the usual spherically symmetric approximation are to be expected, especially from electrons in a hexagonal environment, and that these deviations lead to a new technique for determining the spatial symmetry of the outer electrons in crystalline fields. Using this technique the measured x-ray and neutron scattering factors have been analyzed to determine the outer electron distribution in iron and nickel and compared with the calculated effects of asphericity. The polarized neutron data of Nathans, Shull, et al., indicates that in b.c.c. iron the doubly and triply degenerate orbitals are equally populated, while in nickel the holes are 75% in the triply degenerate orbitals and 25% in doubly degenerate orbitals. Combining these results with the x-ray data, further analysis shows that in b.c c. iron the spin density arises from 2.2 3d atom-like electrons in one spin direction, whereas in nickel the spin density arises from 5.0 3d atom-like electrons with spin up and 4.4 3d atom-like electrons with spin down. In nickel it is shown that the spin-up electrons have a radial charge density slightly more compressed than that of the spin-down electrons. (auth)

2829

SOME PHYSICAL PROPERTIES OF NEPTUNIUM METAL. I. A DETERMINATION OF THE SPECIFIC HEAT OF α-NEPTUNIUM. J. P. Evans and P. G. Mardon (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. and Chem. Solids 10, 311-13(1959) Aug.

The specific heat of neptunium over the α-phase range has been determined by a simple calorimetric method. The value of C_p increases from 0.031_4 cal/g at 60°C to 0.40_2 cal/g at 207°C. In a separate determination, the latent heat of the $\alpha \rightarrow \beta$ transformation was found to be 2.0 ± 0.2 kcal/mole. (auth)

2830

PHOTOCONDUCTIVITY IN INDIUM SULFIDE POWDERS AND CRYSTALS. Richard H. Bube and William H. McCarroll (RCA Labs., Princeton, N. J.). Phys. and Chem. Solids 10, 333-5(1959) Aug.

Methods for the preparation of indium sulfide and the photoconductivity measurements on powders and crystals are reported. (J.E.D.)

2831

LOW-TEMPERATURE SPECIFIC HEAT OF LIQUID He^3 NEAR THE SATURATED VAPOR PRESSURE AND AT HIGHER PRESSURES. D. F. Brewer, J. G. Daunt, and A. K. Sreedhar (Ohio State Univ., Columbus). Phys. Rev. 115, 836-42(1959) Aug. 15.

The specific heat of liquid He^3 was measured near the saturation vapor pressure in the range 0.085 to 0.75°K, and at pressures up to the melting pressure between 0.12 and 0.6°K. There is no evidence of a specific heat transition in the range of measurements. Near 0.1°K the specific heat near the saturated vapor pressure appears to tend linearly to zero at 0°K with a slope of 4.0 ± 0.1 cal/mole deg^2, providing evidence for regarding He^3 as a Fermi liquid near this temperature with an effective excitation mass of (2.00 ± 0.05) × the mass of a He^3 atom. Entropies calculated with this linear extrapolation and with the assumption that no transition occurs below 0.085°K agree well with previous evaluations. Measurements at higher pressures show a negative dependence of specific heat on pressure above 0.16°K, but a positive dependence below this temperature, in contradistinction to the case of an ideal Fermi gas. (auth)

2832

EXPANSION COEFFICIENT AND ENTROPY OF LIQUID He^3 UNDER PRESSURE BELOW 1°K. D. F. Brewer and J. G. Daunt (Ohio State Univ., Columbus). Phys. Rev. 115, 843-9(1959) Aug. 15.

Measurements were made of the change of temperature on adiabatic expansion of liquid He^3 in the temperature range 0.15 to 1.15°K, at average pressures up to 22 atmospheres. From these measurements, evaluations were made of the expansion coefficient, α_p, at constant pressure, and of the change in entropy on compression from the saturated vapor pressure to higher pressures. The latter calculations, combined with the previously determined entropy at the saturated vapor pressure, give values of S_p, the absolute entropy under pressure. It is found that at all pressures α_p is negative up to a temperature T_0 which is a monotonically increasing function of pressure. Correspondingly, at sufficiently low temperatures $(\partial S_p/\partial p)_T$ is positive for all pressures, in agreement with theory. The S_p isobars allow plausible extrapolations to the absolute zero, from which the limiting slope at 0°K was estimated. Comparison of these slopes with the very-low-temperature nuclear magnetic susceptibility yield some information concerning the variation with pressure of the spin-dependent interactions in liquid He^3. (auth)

2833

ELECTRIC AND MAGNETIC PROPERTIES OF THE HYDROGEN MOLECULE. T. P. Das and R. Bersohn (Columbia Univ., New York). Phys. Rev. 115, 897-910 (1959) Aug 15.

The hydrogen molecule ground state has been studied for a long time by valence theorists. Comparison with experiment was limited to the energy, bond distance, vibration frequency, and the electric and magnetic polarizabilities. Recent radio-frequency experiments on hydrogen yielded new quantities, the nuclear magnetic shielding constant, the spin-spin coupling constant, and the electric field gradient at the nucleus. Variation methods are described for the calculation of the new types of polarizability. These methods can be applied to more complex molecules and appear to open new possibilities for the semiquantitative interpretation of the results of high-resolution nuclear magnetic resonance. An extensive comparison is made between the experimental quantities and theoretical values using various wave functions. The most important factor affecting the accuracy of the charge density is the use of an effective nuclear charge. (auth)

2834

COLLISION-INDUCED SPIN FLIP OF HYDROGEN ATOMS. Oldwig von Roos (California Inst. of Tech., Pasadena). Phys. Rev. 115, 911-18(1959) Aug 15.

The cross section of a radiationless electronic spin-state transition (triplet-singlet transition) of two colliding, unexcited, hydrogen atoms was calculated for low relative velocities. The low-velocity limit of this cross section exhibits a logarithmic divergence and decreases rapidly to a value of the order of πr_0^2 (r_0 = classical electron-radius $e^2/4\pi mc^2$) with increasing energy of relative motion. (auth)

2835

RESONANCE ELECTRON EXCHANGE IN LARGE-ANGLE SCATTERING OF He^+ ON He AT kev ENERGIES. F. P. Ziemba and A. Russek (Univ. of Connecticut, Storrs). Phys. Rev. 115, 922-5(1959) Aug. 15.

Recent differential scattering measurements at 5° scattering angle of He^+ on He at energies of 2 to 250 kev show several pronounced resonance peaks when the fraction of the scattered particles which were neutral (electron exchange) was plotted as a function of incident energy. A detailed comparison of those experimental data is made with

the theoretical predictions of the impact parameter method for resonance electron capture. The agreement between the theory and experiment is found to be quite good at high energies despite experimental indications of a large amount of excitation. The contribution of electron exchange with excitation is then considered in the light of this fact. (auth)

2836

CIRCULAR POLARIZATION OF GAMMA RADIATION FOLLOWING ALLOWED BETA TRANSITIONS. R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys Rev. 115, 980-5(1959) Aug. 15.

The degree of circular polarization of gamma rays following allowed beta transitions was investigated as a function of the angle $\Theta_{\beta\gamma}$ between beta-particle momentum and gamma direction and as a function of the energy of the beta particle. The anisotropy of the beta-gamma circular polarization correlation observed for pure Gamow-Teller transitions ($\Delta I = 1$) is used to determine the validity of $C_{A'} = C_A$. The experimental results for Co^{60} and Na^{22} are $W(\Theta_{\beta\gamma}) = 1 - (0.345 \pm 0.019)(v/c)\cos\Theta_{\beta\gamma}$ and $W(\Theta_{\beta\gamma}) = 1 + (0.35 \pm 0.02)(v/c)\cos\Theta_{\beta\gamma}$, respectively. These values yield $C_{A'} = (1 \pm 0.2)C_A$. The degree of circular polarization of the gamma rays following mixed beta transitions ($\Delta I = 0$) confirms the existence of V-A interference terms. For Sc^{46} and Na^{24} the beta-gamma circular polarization correlations, $W(\Theta_{\beta\gamma}) = 1 + (0.24 \pm 0.02)(v/c)\cos\Theta_{\beta\gamma}$, and $W(\Theta_{\beta\gamma}) = 1 + (0.07 \pm 0.03)(v/c)\cos\Theta_{\beta\gamma}$, were observed. From these measurements the ratios of Fermi to Gamow-Teller components for the Sc^{46} beta transition, $(M_F/M_{GT})^2 = 0.13 \pm 0.04$, and for the Na^{24} beta transition, $(M_F/M_{GT})^2 = 0.002 \pm 0.010$, were determined. (auth)

2837

CONFIGURATION INTERACTION IN ALKALI HALIDE PHOSPHORS. Robert S. Knox (Univ. of Illinois, Urbana). Phys. Rev. 115, 1095-1106(1959) Sept. 1.

It is shown that excited state wave functions of free activator ions do not provide a completely adequate basis for a quantitative theory of the luminescence of alkali halides activated by heavy metals. It is proposed that better zero-order wave functions may be obtained by allowing interaction between different types of states of excitation, and as a practical example of an electronic configuration which can interact with excited activator configurations, the electron transfer states of the Seitz model are discussed in detail. These states have generally been ruled out because of the absence of a halogen-like doublet in the phosphor absorption spectra, but a closer analysis shows that the doublet character of the activator atom is of equal importance. Neither of the doublets is expected to appear explicitly in the spectra. A numerical estimate of the coupling between an excited activator 6s6p state and a typical electron transfer state indicates the possibility of strong interaction between these configurations. It is concluded that the Seitz model is capable of explaining recent experiments on excitation bands, polarization effects, and lattice structure dependence of absorption spectra, provided that more emphasis is placed on electron-transfer states or other excited states of the host crystal which can interact with excited activator configurations. (auth)

2838

ELECTRON IRRADIATION OF INDIUM ANTIMONIDE. L. W. Aukerman (Purdue Univ., Lafayette, Ind.). Phys. Rev. 115, 1125-32(1959) Sept. 1.

The effects of 4.5-Mev electron bombardment on the electrical properties of n- and p-type InSb are studied. Isochronal annealing experiments carried out on samples bombarded at 80°K indicate three regions of rapid annealing the first two between 80 and 200°K and the third near room temperature. It is shown that the distribution of bombardment-produced energy levels is altered by heating a bombarded specimen to 200°K. The changes which occur as a result of this heat treatment suggest that energy levels that shift as defects rearrange themselves into positions of greater stability. For samples bombarded at 200°K, the positions of energy levels and the rates at which they are generated are determined from careful studies of the temperature dependence of carrier concentration. Mobility changes are utilized to identify donor or acceptor behavior. The levels introduced into the forbidden band appear to be multiply ionized. (auth)

2839

ELECTRON IRRADIATION OF INDIUM ARSENIDE. L. W. Aukerman (Purdue Univ., Lafayette, Ind.). Phys. Rev. 115, 1133-5(1959) Sept. 1.

The carrier concentration of n-type InAs increases during irradiation with 4.5-Mev electrons. The increase is followed to a carrier concentration of $10^{17}/cm^3$. The carrier concentration of p-type samples decreases with irradiation. The increase in the electron concentration suggests that bombardment-produced donors are at least doubly ionized, even when the Fermi level is in the conduction band. Initially p-type samples exhibited anomalies which may result from n-type conduction in the vicinity of dislocations. (auth)

2840

MANY-PARTICLE APPROACH TO THE ONE-ELECTRON PROBLEM IN INSULATORS AND SEMICONDUCTORS. Abraham Klein (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 115, 1136-46(1959) Sept. 1.

A formal theory of one-electron states in insulators and semiconductors is developed from a many-particle point of view. The techniques of second quantization are utilized for this purpose in a manner analogous to that introduced recently for the study of Fermi liquids, i.e., by the study of matrix elements of the electron field operator which describe the propagation of particles or holes. Both types of motion are described symmetrically by means of the one-particle Green's function or propagator, the utility of which is derived from the existence of a gap against single-particle excitation. The motion of electrons near the bottom of the conduction band in the presence of external electric and magnetic fields whose spatial variation over one lattice spacing is small and contains no frequencies comparable with the gap frequency which is governed by a simple Schrödinger equation. The latter contains as parameters only the effective mass (as measured in a cyclotron resonance experiment), the static dielectric constant, and magnetic permeability of the solid. The proof, within the restriction of a fixed, perfect lattice, takes into account all many-body effects. A similar theorem obtains for the motion of holes. (auth)

2841

MAGNETIC SUSCEPTIBILITY OF InSb. R. Bowers and Y. Yafet (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 115, 1165-72(1959) Sept. 1.

The magnetic susceptibility of n-InSb was measured for a range of extrinsic carrier densities extending from 10^{16} to 6×10^{18} cm^{-3}. Measurements were made in the temperature range 300 to 1.3°K. The degenerate conduction electron susceptibility was determined from the data. The deviation of the conduction band from parabolic form is clearly exhibited in the susceptibility. A theoretical analy-

sis was made using Kane's band-structure calculation. The mixing of the conduction and valence bands resulting from the magnetic field was treated exactly. Consideration of these two bands alone will not explain the dependence on concentration of the observed susceptibility; at the higher carrier densities, higher bands are important and a perturbation-theoretical treatment of these indicates that the observed susceptibility is consistent with Kane's model. (auth)

2842

ELECTRONIC POLARIZABILITIES OF IONS. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 115, 1198-1206(1959) Sept. 1.

The dipole polarizability α_d was calculated for several ions by solving the Schrödinger equation for the first-order perturbation of the wave functions of the core electrons. General results were obtained for the number of nodes of the various types of perturbed wave functions ($nl \rightarrow l'$) in terms of the principal quantum number n. Tables of the perturbed wave functions for the Na^+ and Cl^- ions are presented. The results for α_d of Na^+, K^+, Rb^+, and Cs^+ are in reasonable agreement with those obtained in previous work. Calculations were carried out for the electric field at the nucleus due to the charge distribution induced in the ion by an external charge. Values of the quadrupole shielding constant γ_∞ were obtained for several helium-like ions. (auth)

2843

ISOTOPE SHIFT OF He 2P. Gentaro Araki, Koichi Mano, and Masao Ohta (Kyoto Univ.). Phys. Rev. 115, 1222-5 (1959) Sept. 1.

The isotope shift of the deepest ^3P and ^1P levels of the helium atom is calculated by making use of wave functions. The theoretical values of the specific isotope shift of the ^3P and ^1P levels are -636.00×10^{-3} cm^{-1} and 453.83×10^{-3} cm^{-1}, respectively, which are in fairly good agreement with the observed values $(-642 \pm 5) \times 10^{-3}$ cm^{-1} ($2\,^3P$) and $(461 \pm 5) \times 10^{-3}$ cm^{-1} ($2\,^1P$). (auth)

2844

THE SYNTHESIS OF REMOTE TRANSURANIAN ELEMENTS. Priroda 48, No. 8, 83-4(1959) Aug. (In Russian)

A short review is presented on synthesis methods. (R.V.J.)

2845

ON THE THEORY OF SYSTEMS OF RAREFIED PARTICLES IN AN EXTERNAL FIELD. I. R. Yukhnovskii, I. Sh. Rakhimova, and V. V. Vladimirov (I. Frank L'vov State Univ.). Ukrain. Fiz. Zhur. 4, 334-44(1959) May–June. (In Ukrainian)

A system of ions in an external field is considered, the short and coulomb forces being taken into account. The free energy of the system is found. A method is developed for functional indeterminate differentiation, which leads to distribution functions. (auth)

2846

RESULTS OF LOW-TEMPERATURE RESEARCH. XXIV. COMPARISON OF MOLAR HEAT CAPACITY, HEAT OF CONVERSION, HEAT OF FUSION, AND ENTROPY OF CONDENSED N_2^{14} AND N_2^{15} ISOTOPES. K. Clusius, A. Sperandio, and U. Piesbergen (Universität, Zurich). Z. Naturforsch. 14a, 793-801(1959) Sept. (In German)

Five liters of very pure heavy nitrogen (N_2^{15}) with an N^{15} content of 99.0% were prepared in a separation tube plant. Its thermal properties were compared with light nitrogen (N_2^{14}). The values compared are for N_2^{14} and N_2^{15}, respectively: Debye temperature at 10°K (solid N_2) 73°, 72°; conversion temperature ($\alpha \rightarrow \beta - N_2$) 35.61°K, 35.68°K; heat of conversion 55.62 cal/mole, 56.61 cal/mole; melting point (solid → liquid) 63.14°K, 63.19°K; heat of fusion 172.26 cal/mole, 172.21 cal/mole; boiling point (liquid → gas) 77.32°K, 77.39°K; heat of vaporization 1332.9 cal/mole, 1336.5 cal/mole; thermally measured entropy at 25°C 55.71_2 clausius, 46.06, clausius; and statistically calculated entropy at 25° 45.73_4 clausius, 46.07_6 clausius. All phase transition temperatures were higher for N_2^{15} than for N_2^{14}. This is also the case for combined heat tone; however, the heats of fusion within the limit of error were also large. The thermal entropy derived from measurements for ideal gas conditions, agreed with the statistically calculated value to better than 0.03 clausius, when the nuclear spin entropy is neglected. For the mixed molecule ($N^{14}N^{15}$) the behavior of a null-point entropy of R ln 2 is included, which perhaps is compensated below 1°K just as the nuclear spin entropy is through a still unknown anomaly of the molar heat capacity. (tr-auth)

2847

A COMPARISON OF THE RESULTS OF TWO METHODS OF MEASUREMENT OF THE ISOTOPE EFFECT IN ELECTROLYTIC TRANSPORT IN MOLTEN NITRATES. Arnold Lundén (Chalmers Technische Hochschule, Göteborg). Z. Naturforsch. 14a, 801-5(1959) Sept. (In German)

The isotope effect in electrolytic transport was measured using separator tubes or by electrophoresis in asbestos paper, whereby the mobility of cations with respect to the anions or the asbestos paper was given. Experiments which gave mobilities with respect to the union were carried out for both methods. The reasons for possible differences in the isotope effects resulting from the two methods are discussed. (tr-auth)

2848

FORMATION OF NEGATIVE HYDROGEN IONS IN AN INCANDESCENT TUNGSTEN SURFACE. V. I. Khvostenko and V. M. Dukel'skii (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 651-3(1959) Sept. (In Russian)

Formation of H^- ions on an incandescent tungsten surface was observed. A value of 0.8 ± 0.1 ev was obtained for the electron affinity of the hydrogen atom, from the temperature dependence of the ratio of the negative ion current to the electron current in the 2600 to 2900°K range. (auth)

2849

DIFFRACTION OF X-RAYS IN POLYCRYSTALLINE SAMPLES OF HYDROGEN ISOTOPES. V. S. Kogan, B. G. Lazarev, and R. F. Bulatova. Zhur. Eksptl'. i Teoret. Fiz. 37, 678-83(1959) Sept. (In Russian)

Comparison of the interference patterns obtaining in x-ray scattering on the polycrystalline samples of hydrogen isotopes indicates the existence of isotopic polymorphism. The difference in the structure of hydrogen and deuterium and the proximity of the structure of the latter to that of tritium indicates that polymorphism is not due to a difference in the energy spectra but to a difference in the atomic weights of the hydrogen isotopes. The observed differences in structure of the hydrogen isotopes agree with the hydrogen-deuterium state diagram. Data presented in the paper pertaining to the parameters characterizing the structure of hydrogen isotopes (tritium and deuterium have a tetragonal lattice with $c/a = 1.73$ and $a = 3.3$ and 3.35 Å, respectively, hydrogen has a tetragonal lattice with $c/a =$

0.82 and a = 4.5 Å or hexagonal lattice with c/a = 1.73 and a = 3.7 Å) are in agreement with density data and with the results of roentgenographic investigations of isotopic mixtures nevertheless require further correction by methods which yield the complete interference patterns. (auth)

2850

THE PROBLEM OF CRITICAL VELOCITIES IN HE II FLOW IN CYLINDERS. B. T. Geilikman (Lenin Moscow State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 891-2(1959) Sept. (In Russian)

The order of magnitude of critical velocities in eddy rings and currents of helium flow in a long cylindrical channel is estimated. (R.V.J.)

2851

ARRANGEMENT FOR OBTAINING SUPERLOW TEMPERATURES AND FOR NUCLEAR ORIENTATION. A. B. Kogan, N. M. Reinov, I. A. Sokolov, and M. F. Stelmakh (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 1039-47(1959) Aug. (In Russian)

The design and performance of an installation for cryogenic studies below 1°K are described. Temperatures below 1°K can be maintained from 30 to 40 min to several hours. The temperature and maximum heat loss time depend upon the paramagnetic salts used for adiabatic demagnetization. Two typical warming curves for specimens of chromium potash alum and binary cerium–magnesium nitrate [3 $mg(NO_3)_2 \cdot 2\ Ce(NO_3)_3 \cdot 2y\ H_2O$] are shown. The warming time is sufficient for experiments with oriented nuclei. (R.V.J.)

2852

ON THE CHERENKOV EFFECT FOR CHARGE MOVING ABOVE AN INTERFACE. A. G. Sitenko and V. S. Tkalich. Zhur. Tekh. Fiz. 29, 1074-85(1959) Sept. (In Russian)

The cherenkov radiation of charged particles in motion and for a charged modulated beam in motion near a dielectric is measured. (R.V.J.)

2853

ON THE COAGULATION OF AEROSOLS BY FREE STREAMS OF GAS. P. N. Kubanskii. Zhur. Tekh. Fiz. 29, 1140-1(1959) Sept. (In Russian)

Analysis is made of the causes producing coagulation of aerosols by "sharp" gas stream blasts. It is suggested that finer jets intensify coagulation. (R.V.J.)

2854

EXPLODING WIRES. William G. Chance and Howard K. Moore, eds. New York, Plenum Press, Inc., 1959. 373p. $9.50.

Experimental and theoretical approaches are presented on exploding wire phenomenon. Different mechanisms which describe the explosions of wires in the cases where the current paused and where no pause occurred are discussed. Measurements made on current flow during the dwell time of an exploding wire at atmospheric and reduced pressure indicate that conduction must be by gaseous electrons, ions, or both. A correlation between small and large exploding wires was found to exist relative to pause time versus length dependency. An analysis of short duration currents in a wire shows that the skin effect can cause a time-dependent radial distribution of current in the wire. The electrical behavior of fine wires exploded by a coaxial cable discharge system is described. The production of a high-intensity source with a temperature in the million degree range is discussed. The pinch effect associated with such extreme temperatures is also discussed. Submicrosecond explosions in Al, Cu, Au, Ni, Ag, and W wires are reported along with radiometric temperature measurements on Al, Cu, and W wires. Optical studies on exploding wire phenomenon by Kerr cell schlieren photography and cinemicroscopic observations are discussed. The use of the action integral ($I(t) = \int I^2 dt$) is demonstrated in exploding wire studies. Flow fields produced by shock waves are studied and a theoretical model which assumes instantaneous energy deposition in the wire was set up to analyze hydrodynamic flow. By expanding the solution of the basic gas dynamic equation in a series of (c/U^2), studies were conducted on the propagation of cylindrical shock waves. Formulas are developed for calculating the required wire resistance to produce maximum temperature from an available energy storage arrangement. Experiments on the application and use of exploding wires include: bonding with exploding foil, image formation by rapid vaporization of metal filaments in vacuo, photochemistry applications, high power pulse steepening, high voltage fuse for capacitor bank protection, and in plasma acceleration. Designs are presented for a three-channel delayed wire explorer unit and a high-speed framing camera for photographing exploding wire phenomena. (C.J.G.)

2855

ELECTRONIC ANALOG COMPUTER FOR DETERMINING RADIOACTIVE DISINTEGRATION. H. P. Robinson (to U. S. Atomic Energy Commission). U. S. Patent 2,894,688. July 14, 1959.

A computer is presented for determining growth and decay curves for elements in a radioactive disintegration series wherein one unstable element decays to form a second unstable element or isotope, which in turn forms a third element, etc. The growth and decay curves of radioactive elements are simulated by the charge and discharge curves of a resistance-capacitance network. Several such networks having readily adjustable values are connected in series with an amplifier between each successive pair. The time constant of each of the various networks is set proportional to the half-life of a corresponding element in the series represented and the charge and discharge curves of each of the networks simulates the element growth and decay curve.

2856

METHOD OF PREPARING POLONIUM–BORON SOURCES. J. H. Birden (to U. S. Atomic Energy Commission). U. S. Patent 2,898,473. Aug. 4, 1959.

An improved technique is described for preparation of a polonium-boron neutron source. A selected amount of Po-210 is vaporized into a thin walled nickel container, then the desired amount of boron powder is added. After sealing the container, it is heated quickly by induction heating to vaporize the Po-210 and deposit it in the still cool boron powder. The unit is then quickly cooled to prevent revaporization of the Po-210 from the boron. The build-up of neutron emission may be followed by means of a neutron counter in order to terminate the heating at the optimum level of neutron yield.

Astrophysics and Cosmology

2857

THE DISTRIBUTION OF RELATIVISTIC ELECTRONS IN THE GALAXY AND THE SPECTRUM OF MAGNETIC BREMSSTRAHLUNG RADIO EMISSION. S. I. Syrovatskii. Astron. Zhur. 36, 17-32(1959).

Consideration of the regular energy changes of particles leads to a theoretical solution of the problem on the diffu-

sion. By making assumptions on the sources in the interstellar space, the space distribution and energy spectrum for electrons, the energy changes of which are caused by losses due to radiation in the magnetic field were found. A special case is discussed in detail. The energy spectra of electrons and the corresponding intensity of magnetic bremsstrahlung radiation were calculated and the obtained results are discussed. (TCO)

2858

PRIMARY AND SECONDARY OBJECTS. Harold C. Urey (Univ. of California, La Jolla). J. Geophys. Research 64, 1721-37(1959) Nov.

The composition of various iron and strong-iron meteorites is discussed. Various theories concerning the origin of meteorites are reviewed. (C.J.G.)

Cosmic Radiation

2859 AFOSR-TN-59-1068

New Mexico. Univ., Albuquerque.

SIZE-SPECTRUM OF EXTENSIVE AIR SHOWERS OF THE COSMIC RADIATION. John R. Green and James R. Barcus. Oct. 7, 1959. 16p. Contract AF49(638)-34.

The operation and calibration of a single scintillator of area 7.3 m^2 is discussed. The results from scintillator analyzing circuits are combined to give the integral spectrum of pulses occurring in the scintillator at 10 to a few times 10^3 particles. From about 30 particles to the upper limit of the apparatus, the spectrum of pulses in the scintillator is very regular and has a constant logarithmic slope of −1.51. From this fact and from the theoretically predicted response of a single scintillator to extensive air showers, it is deduced that the extensive air showers in the range from 10^5 to 10^8 particles also have a regular integral spectrum which is given by $K(\geq N) = 3.2 \times 10^{-7} (N/10^6)^{-1.51}$ $m^{-2}sec^{-1}str^{-1}$. The spectrum of scintillator pulses below about 30 particles shows a marked change of slope. This is shown to be the result of a different phenomenon, namely, the local production of small nuclear events in the liquid of the scintillator. The integral spectrum of such events dissipating E Mev in the scintillator liquid is given by $R(\geq E) = 4.5 \times 10^2 E^{-2.76}$ min^{-1} per gm of toluene. (auth)

2860 NP-tr-304

INVESTIGATION OF COSMIC RAYS DURING PERIOD OF INTERNATIONAL GEOPHYSICAL YEAR (IGY). By Yu. G. Shafer. Translated from Izvest. Sibir. Otdel. Akad. Nauk S.S.S.R. No. 8, 3-18(1958). 34p. OTS.

During the IGY, the Cosmic Ray Laboratory at the Yakutsk Branch of the USSR Academy of Sciences conducted a series of investigations in the field of cosmic-ray variation. The content, certain results, instruments, and observational methods of these investigations are described. (W.D.M.)

2861

DETECTION OF 10 kev ELECTRONS IN THE UPPER ATMOSPHERE BY THIRD ARTIFICIAL SATELLITE. V. I. Krasovskiĭ, I. S. Shklovskiĭ, Yu. I. Gal'perin and E. M. Svetlitskiĭ (Inst. of Physics and Atmosphere, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 8, 1157-63(1959) Aug.

Data are presented on 10 to 40 kev electron showers measured by the third Soviet artificial satellite by means of two fluorescent screens, coated with absorbing aluminum foils and viewed with photomultipliers. The shower intensity increases sharply with reduced energy. The energy at high altitudes reaches several decades of erg/cm^2 sec. (R.V.J.)

2862

PENETRATION OF FAST CHARGED PARTICLES FROM UPPER ATMOSPHERE INTO IONOSPHERE. V. D. Pletnev (Inst. of Physics and Atmosphere, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. No. 8, 1164-6(1959) Aug.

The oscillating motion of charged particles collected by the Terrestrial magnetic field is studied. It is shown that the direction of such oscillating particle fluxes have a strongly expressed spatial anisotropy due to the absorption effect of the lower atmosphere layers. (tr-auth)

2863

THE GEOMAGNETICALLY TRAPPED CORPUSCULAR RADIATION. James A. Van Allen (State Univ. of Iowa, Iowa City). J. Geophys. Research 64, 1683-9(1959) Nov.

The size, composition, location, and theories of the origin of geomagnetically trapped corpuscular radiation are discussed. (C.J.G.)

2864

LOW-ENERGY COSMIC-RAY EVENTS ASSOCIATED WITH SOLAR FLARES. George C. Reid and Harold Leinbach (Univ. of Alaska, College). J. Geophys. Research 64, 1801-5(1959) Nov.

The measurement of ionospheric absorption in arctic regions was found to be a sensitive method of detecting low-energy cosmic rays associated with solar flares. The normal morphology of these events is described, and details are given of the 24 such events that were detected in the period from May 1957 through July 1959. Two features were noted; an apparent asymmetry in the distribution of cosmic-ray-producing flares across the solar disk, and a pronounced degree of uniformity in the distribution of the radio-wave absorption over the terrestrial polar cap. These features are discussed, and tentative explanations are suggested. (auth)

2865

COSMIC-RAY MEASUREMENTS IN THE VICINITY OF PLANETS AND SOME APPLICATIONS. PART I: PRIMARY COSMIC RADIATION. S. F. Singer and R. C. Wentworth (Univ. of Maryland, College Park). J. Geophys. Research 64, 1807-13(1959) Nov.

The variation of the primary cosmic-ray intensity is calculated as a function of distance from a dipole in its equatorial plane. Different values of spectrum exponent and of minimum momentum are chosen. Results are presented in a general form but are also specialized to the case of the moon. Scientific applications are indicated, such as determination of the cosmic-ray energy spectrum and low-energy cutoff, cause of the 'knee' and of Forbush decreases, value of the free-space cosmic-ray flux, and determination of magnetic fields of the moon and the planets. (auth)

2866

A METHOD FOR MEASURING LOCAL ELECTRON DENSITY FROM AN ARTIFICIAL SATELLITE. L. R. O. Storey. J. Research Natl. Bur. Standards 63D, 325-40 (1959) Nov.-Dec.

A method is proposed for measuring the electron density at known points in the outer ionosphere, by the use of vlf receiving equipment in an artificial satellite, in conjunction with a vlf transmitter on the ground. The transmitter would radiate continuous waves, which would be propagated through the ionosphere in the "whistler" mode. The basis of the method is a measurement of the local wave admittance of the medium, by comparison of the signals received on an electric dipole and on a loop. A proposal is made for an integrated vlf satellite experiment, in which several dif-

ferent types of observation would be made simultaneously. (auth)

2867

THE PRODUCTION OF COSMIC RADIATION BY A SOLAR FLARE ON AUGUST 31, 1956. K. G. McCracken (Univ. of Tasmania, Hobart, Australia). Nuovo cimento (10) 13, 1074-80(1959) Sept. 16.

It is shown that the neutron counting rates observed by three widely separated recorders increased by approximately two percent about half an hour after the observation of an intense solar flare at 1226 U.T. on August 31, 1956. The event, as observed at all three stations, exhibited the abrupt onset and gradual recovery typical of solar flare effects. The time delay between the first visual sighting of the flare and the earliest arrival of cosmic radiation at the earth was about 20 min. It is shown that the quantity of cosmic radiation which arrived at the earth was two to three orders of magnitude less than the quantities which arrived during earlier flare effects. Consideration of the temporal dependence of the small flare effect suggests that only a small quantity of cosmic radiation was produced in the solar flare. (auth)

2868

A CORRELATION BETWEEN THE EMISSION OF WHITE LIGHT AND COSMIC RADIATION BY A SOLAR FLARE. K. G. McCracken (Univ. of Tasmania, Hobart, Australia). Nuovo cimento (10) 13, 1081-5(1959) Sept. 16.

It is pointed out that the majority of the solar flares which were observed to produce increases in the terrestrial cosmic ray intensity were also observed in white light. This is interpreted as evidence that it is only the most energetic flares which produce any appreciable quantity of cosmic radiation and that the rarity of the cosmic ray flare effect is, at least in part, due to the rarity of very energetic solar flares. Evidence is presented that suggests that cosmic radiation produced in a flare on the east limb of the sun is unable to reach the earth. (auth)

2869

SEARCH FOR 550m_e PARTICLES IN THE SEA-LEVEL COSMIC RADIATION. I. B. McDiarmid (National Research Council, Ottawa). Phys. Rev. 115, 1016-19(1959) Aug. 15.

An attempt was made to observe a 550m_e particle in the sea-level cosmic radiation. A counter arrangement biased against the detection of μ mesons was used to select particles stopping in a multiplate cloud chamber. From the mass spectrum of these particles, determined from ionization and range measurements, an upper limit of 0.02% was obtained for the intensity of 550m_e particles relative to μ mesons stopping in the same range interval. A similar upper limit was also obtained by a method independent of mass measurements for the particular case in which one of the decay products of a 550m_e particle is a π^0 meson. (auth)

2870

TERRESTRIAL CORPUSCULAR RADIATION. A. E. Chudakov and E. B. Gorchakov (Lebedev Inst. of Physics, Moscow and Lomonosov Moscow State Univ.). Prirode 48, No. 8, 86-9(1959) Aug. (In Russian)

Artificial sattelite and cosmic rocket measurements revealed two zones in the terrestrial corpuscular radiation. The zones differ in particle composition and spatial distribution. It is postulated that the outer and inner zone also differ in their origin: the inner zone originating by a neutron injection mechanism, the outer zone being formed by solar particles entering the terrestrial magnetic field. (R.V.J.)

2871

POTASSIUM AS REACTION PRODUCT OF COSMIC RADIATION IN IRON METEORITES. H. Voshage and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 828-38(1959) Sept. (In German)

The isotopic abundance of K in iron meteorites was determined. Since the K concentration in Fe meteorites is extremely small, and since the slightest contamination by terrestrial K can lead to large distortions of the mass spectrum of meteoritic K, new methods must be developed for separation of about 10^{-9} to 10^{-8} g of K from meteorite samples of only a few grams, and for mass spectrometric isotope abundance determination in small amounts of K. The mass spectrum is given by superimposition of mass spectra from three different types of K: (1) cosmogenic K which results from interaction of cosmic rays on meteorites by a spallation process on iron nuclei and which has a much more uniform isotopic abundance distribution than the "general" terrestrial K; (2) K already existing in the meteorite which has almost the same isotope distribution as terrestrial K; (3) contamination with normal terrestrial, for example, resulting from self-emission of K-ion sources. Under conditions in which the latter of these fractions was least important, the following relative abundances for three different iron meteorites were measured: Carbo-K^{39} 79.5%, K^{40} 4.8%, K^{41} 15.7%; Treysa-K^{39} 85.35%, K^{40} 3.10%, K^{41} 11.55%; Clark County-K^{39} 90.8%, K^{40} 0.8%, K^{41} 8.4%. Conclusions as to the differences in history (perhaps the radiation age) of the Carbo and Treysa Meteorites are produced by the measurements. (tr-auth)

2872

GENERATION OF K^+-MESONS BY COSMIC RAY PROTONS AT AN ALTITUDE OF 3250 m ABOVE SEA LEVEL. M. Ya Balats, P. I. Lebedev, and Yu. V. Obukhov. Zhur. Eksptl'. i Teoret. Fiz. 37, 589-95(1959) Sept. (In Russian)

The spectrum is presented and an estimation is made of the cross section for production of K^+ mesons by cosmic ray protons in the K^+ particle momentum interval up to 0.9 Bev/c. The investigation was carried out at an altitude of 3200 m above sea level (Mount Alagez). (auth)

2873

INVESTIGATION OF π^0-MESON GENERATION IN THE INTERACTION OF COSMIC RAY PROTONS AND α-PARTICLES WITH CARBON NUCLEI. K. I. Alekseeva, S. I. Brikker, N. L. Grigorov, V. S. Murzin, and F. D. Savin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 596-603(1959) Sept. (In Russian)

Pulse ionization chambers and a hodoscope were used in a stratosphere study at geomagnetic latitude of 31° N of the interaction of primary protons and alpha particles with carbon nuclei. The electron cascade produced in lead by γ quanta from decay of neutral π mesons generated in the interaction is investigated. It is found that in the interaction of protons and α particles with carbon nuclei in the 10^{10} ev energy region, on the average, (10 ± 3)% and (14 ± 10)% of the primary particle energy is, respectively, spent in π^0-meson generation. (auth)

2874

NONMESON DECAYS OF HYPERFRAGMENTS. I. B. Berkovich, A. P. Zhdanov, F. G. Lepekhin, and Z. S. Khokhlova (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 604-10(1959) Sept. (In Russian)

In a systematic inspection of 47 cm^2 of an emulsion irradiated by 4.5 Mev π mesons, 8 double stars were detected in which the connecting track narrowed down and one of the secondary tracks had a range >5000 μ and which

could be attributed to nonmeson decays of hyperfragments with Z = 2 + 6. Identification of the hyperfragments and secondary decay products is performed. Possible decay schemes of the hyperfragments are presented under the assumption that one neutron is emitted. (auth)

2875

INVESTIGATION OF A SHOWER CONSISTING OF 200,000 PARTICLES AND RECORDED BY A PHOTOGRAPHIC PLATE. N. L. Grigorov and M. A. Kondrat'eva (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 684-9(1959) Sept. (In Russian)

Electron sensitive photographic plates were used to study the space and angular distribution of particles in a large shower in lead. It is shown that for a shower energy of 4×10^{13} ev the spatial distribution of all the particles and the angular characteristics of particles of the central part of the shower agree with the cascade theory. (auth)

Criticality Studies

2876 KAPL-M-GDH-2

Knolls Atomic Power Lab., Schenectady, N. Y.

A COMPARISON BETWEEN EXPERIMENTAL AND CALCULATED RESULTS IN THE REGION FROM 68°F–550°F OF AN 8" × 30" × 32" CORE HAVING VARIOUS WEIGHT PERCENT B-10 STAINLESS STEEL SEPTA. G. D. Hickman, J. A. Bistline, and L. A. Mac Naughton. Oct. 2, 1959. 101p. Contract W-31-109-Eng-52. OTS.

A series of fifteen experiments was carried out on an 8 × 30 × 32 in. core in the Pressurized Critical Assembly at KAPL. In twelve of these experiments there was a 0.030 in. boron stainless steel septum bisecting the 8 in. dimension. These septa contained various weight percent B^{10}. In the remaining three experiments there were no boron-stainless steel septa in the core. The eigenvalues and neutron density distributions were compared with values which were calculated using Deutsch cross sections and "Thin Region Theory." The eigenvalues which were calculated were within 1% of the experimental values, with a spread of approximately 1%. For all the cores the calculated eigenvalues were lower than the experimental values. Analyses of the neutron density distributions showed the calculated results in fairly good agreement with the experimental results. In all cases this agreement was as good for the cores which contained the boron septa as for the ones which did not. It therefore appears that the boron has been well represented by "Thin Region Theory," and that the main discrepancies between calculated and experimental values are due to the inadequacies of adapting the Deutsch scheme to these cores. (auth)

2877 NAA-SR-Memo-3892

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CALCULATIONS ON THE TRX CRITICAL ASSEMBLY. L. Maki and W. Allen. [1959?]. 5p. OTS.

The following items were calculated for the different lattice spacing and were compared with the experimental results: resonance escape probability of U^{238}, relative thermal flux in fuel and moderator, and thermal utilization and effective multiplication. (W.L.H.)

2878 NAA-SR-Memo-3980

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CRITICAL MASS OF AN OMR CORE USING PLATE TYPE FUEL ELEMENTS. H. C. Field. June 8, 1959. 4p. OTS.

The clean critical mass of a core using low enrichment U plate-type fuel elements in a six-inch lattice spacing, and using Santowax R at 340°F as the moderator was experimentally determined. Criticality was attained with thirty-nine fuel elements, containing 3915 kg of U, present in the core, three shim rods withdrawn, and the fourth shim rod about 1/8 withdrawn. The interpolated clean critical mass was determined to be 3910 kg of U. (W.L.H.)

2879 NAA-SR-Memo-4057

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

RADIOACTIVITY IN REACTOR COOLANTS. Interim Report. J. E. Stewart. June 30, 1959. 8p. OTS.

The corrosion rates in the OMRE from coolant activation analysis and radiation measurements were determined. The amount of coolant activity due to the recoil process from the stainless steel fuel elements was investigated. A computer program was prepared for the calculation of coolant activity. (W.L.H.)

2880 NAA-SR-Memo-4272

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PROMPT NEUTRON LIFETIME OF THE AETR CRITICAL ASSEMBLY. A. V. Campise. Sept. 1, 1959. 6p. OTS.

Three different calculational methods were used and compared to determine the prompt neutron lifetime of a typical AETR critical assembly. Results were obtained for an AETR critical assembly having a test region containing 23% carbon mixed with U^{233} fuel and structure materials. Results of the three methods are reported. (W.L.H.)

2881 NAA-SR-Memo-4319

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SUGGESTED EXPERIMENTAL FACILITIES FOR THE EXPERIMENTAL ORGANIC COOLED REACTOR (EOCR). John E. Stewart, ed. Sept. 29, 1959. 25p. OTS.

The Organic Moderated Reactor Experiment (OMRE), a minimum cost facility, has demonstrated the feasibility of the organic cooled and moderated reactor concept. The AEC has requested that an Experimental Organic Cooled Reactor (EOCR) be designed with facilities to extend organic reactor technology. Such facilities are recommended. (auth)

2882

ON THE CRITICAL CALCULATIONS BY THE WIENER-HOPF METHOD. T. Asaoka (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 123-7(1959). (In Japanese).

Starting from the familiar integro-differential equation describing the slowing-down and diffusion of neutrons, the critical radius of a two-region thermal neutron reactor with spherical symmetry was calculated by the Wiener-Hopf method. The only assumption is that the diffusion coefficient is proportional to the slowing-down length, which may be less restrictive than generally made. Using the Fermi slowing-down model, the critical radius of the internal region is calculated from an asymptotic solution in each region in which the external region is finitely extended. In that expression the extrapolation distance for the internal region can also be found. The integrals appearing in those expressions is numerically evaluated with little labor. Finally, two numerical examples are given and the results are compared with those obtained by the elementary diffusion approximation. (auth)

Elementary Particles

2883 NP-8055

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

ON THE THEORY OF β-DECAY OF NEUTRON. S. M. Bilenkii (Bilenky), R. M. Ryndin, J. A. Smorodinskii (Smorodinsky), and Ho Tzo-Hsiu. 1959. 10p. (P-400).

The effect of strong interactions on the β-decay of a neutron is formulated taking into account only terms of the order m/M. The effect of weak magnetism and proton recoil are included. Expressions are given for the electron-neutrino correlation in the decay of an unpolarized neutron, electron spectrum, and electron polarization. Electron polarization at 0.71, 0.91, and 1.11 Mev was determined to be 0.14, 0.08, and 0.07%, respectively. (C.J.G.)

2884 NP-8056

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

NEUTRON-PROTON SCATTERING AT 630 MEV. N. S. Amaglobeli and Yu. M. Kazarinov. 1959. 11p. (P-381).

The differential elastic (n-p) scattering cross sections were measured in the angle region 11 to 180° (c.m.s.) at the mean neutron energy 630 Mev. The data coincide within experimental error with the results of previous measurements at 580 Mev. The dependence near the angle 180° was used to determine the pion-nucleon interaction constant using the method proposed by Chew which was found to be $f^2 = 0.06 \pm 0.02$. (auth)

2885 NP-8061

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

THE MULTIPLE PRODUCTION OF PARTICLES IN (pp)- AND (π-p)-COLLISIONS AT ENERGIES OF (1 + 10) BEV. V. S. Barashenkov. 1959. 6p. (P-375).

The calculated probabilities of the 2-,4-,6-prong star production and the calculated number of charged particles produced in (π + p) and (p + p) collisions are given. Interactions between the created pions and the nucleons were taken into account. (W.D.M.)

2886 NP-8062

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

FORM FACTOR AND THE PROBABILITY OF THE β AND μ-DECAY OF THE Λ-PARTICLE. Ho Tso-Hsiu. 1959. 4p. (P-394).

Preliminary experimental results on the transition probabilities of beta and muon decay of the Λ hyperon seem small in comparison with the theoretical value obtained from the elementary theory of the (V-A) type universal weak interaction by considering the Λ as a point particle. To what extent the form factor influences the value of the transition probability of these decay modes is estimated. (W.D.M.)

2887

DEUTERON WAVE FUNCTIONS AND PHENOMENOLOGICAL TWO-NUCLEON POTENTIALS. K. W. Laurikainen. Ann. Acad. Sci. Fennicae Ser. A VI, No. 27, 1-20(1959).

A variational method which gives the wave functions in an analytic form is used to investigate deuteron wave functions corresponding to proposed potentials. The method depends essentially on the soundness of trial functions, which are discussed in detail taking into consideration both central and non-central potentials and potentials containing hard cores or a spin-orbit term. The deuteron ground state corresponding to the half-phenomenological potential of Gammel and Thaler is discussed. (C.J.G.)

2888

NEUTRON THERMALIZATION: SPACE-ENERGY DISTRIBUTION IN HEAVY MEDIA WITH CONSTANT CROSS SECTIONS. Jouko Virkkunen (Finland Inst. of Tech., Helsinki). Ann. Acad. Sci. Fennicae Ser. A VI, No. 33, 1-10(1959).

In his treatment of neutron thermalization in heavy moderators, Kazarnovsky postulates a nonabsorbing medium with constant scattering cross section but with vanishing absorption. The results of Kazarnovsky are generalized, taking into account absorption but assuming in addition that the absorption cross section is constant in space and energy. Using the heavy gas model the present treatment is correlated with the elementary diffusion theory for small energies and at great distances from the source, respectively, and with the Fermi-age theory for high energies. The solution of the general equation is presented in terms of Green's functions in infinite media. The energy spectrum of source neutrons is shown to be uniform maxwellian. (C.J.G.)

2889

K^- p SCATTERING AND $K^- + p \rightarrow Y + \pi$ REACTIONS. J. Szymański (Warsaw Univ.). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 435-9(1959).

Production and scattering cross sections were computed by the "fixed source" approximation for the reactions $K^- + p \rightarrow K^- + p$ and $K^- + p \rightarrow \gamma + \pi$ (γ is a Σ or Λ hyperon) up to 100 Mev. Scalar coupling between the K-meson and baryonic fields is assumed. The cross section for elastic K^--p scattering agreed with experiment for the energy range 0 to 100 Mev. The results for production cross sections were in total disagreement with the experiment. The cross section for Σ^+ production was approximated to be 6 mb at E = 0 and 2 mb at E = 100 Mev, while that for Σ^0 varies in the range 1 to 2 mb and for Σ^- on the order of 0.1 mb. (C.J.G.)

2890

ON THE MASS SPECTRUM OF BARYONS. L. Łukaszuk (Warsaw Univ.). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 515-20(1959).

The mass spectrum of baryons was examined within the scheme of strong interactions given by Królikowski. The calculus was performed in nonrelativistic approximation. The following mass differences were determined: $\Sigma - \Lambda = 160m_e$, $\Xi - N = 754m_e$, and $\Lambda - N = 317m_e$. The assumption was made that the "bare" mass spectrum has a form dependent on the "strangeness" S: $m(S) = m + S_\mu$, where $\mu = 212m_e$ is the mass of the μ-meson. The common cutoff was determined to be $k_{max} = 3.5\mu_\pi = 1\mu_k$ for π and K-interactions. (C.J.G.)

2891

ON THE π^+ DECAY OF A HYPERFRAGMENT. A. Deloff, J. Szymański, and J. Wrzecionko (Inst. for Nuclear Research, Warsaw). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 521-5(1959).

The π^+ emission from a hyperfragment is considered to be the decay of a virtual Σ^+-hyperfragment. Calculations were made to determine the order of magnitude of the frequency of the π^+ decay relative to the number of π^- decays. (C.J.G.)

2892

DISPERSION RELATIONS AND THE PERTURBATION THEORY. O. I. Zavialov (Lomonosov Moscow State Univ.).

Doklady Akad. Nauk S.S.S.R. 128, 273-5(1959) Sept. 11. (In Russian)

The perturbation theory was combined with dispersion relations in studies of forward scattering of K mesons on nucleons. (R.V.J.)

2893

FORMATION OF π MESONS BY POSITIVE 280 Mev PIONS ON NUCLEI IN PHOTOEMULSION. Yu. A. Batusov, N. P. Bogachev, V. M. Sidorov, and I. Chulli. Doklady Akad. Nauk S.S.S.R. 128, 491-4(1959) Sept. 21. (In Russian)

Reactions $\pi^+ + \rho \rightarrow \pi^+ + \pi^+ + N$ and $\pi^+ + N \rightarrow \pi^+ + \pi^- + \rho$ in fast π^+ interactions with nuclei in photoemulsions were investigated. The $\pi^+ + N \rightarrow \pi^+ + \pi^- + \rho$ reaction cross section estimated using data on π^- meson production and considering the meson absorption in nuclei is equal to (0.3 ± 0.2)mb. The $\pi^- + \rho \rightarrow \pi^- + \pi^+ + N$ reaction cross section with the incoming π meson of 280 Mev energy is equal to 0.1 mb. Three events of $\pi^+ + \rho \rightarrow \pi^+ + \pi^+ + N$ and two events of $\pi^+ + \rho \rightarrow \pi^+ + \rho$ were observed in 106 spallations containing at least one π^+ meson. The cross section of the processes at 280 Mev is nearly 10^{-28} cm^2. (R.V.J.)

2894

THE PROPAGATION OF VECTOR WAVES IN NONLINEAR MESODYNAMICS. V. I. Skobelkin (Lomosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 128, 514-16 (1959) Sept. 21. (In Russian)

Generalization of linear vector mesodynamics is achieved by replacing the lagrangian $L = \xi + \zeta + l$, (where l is the invariant part of the lagrangian determining the meson field interactions with nucleons) by an arbitrary function $\Theta = L = \xi + \eta + \zeta + l$ of three invariants of the field $\eta = (EB)^2$, $\xi = (1/8\pi)(E^2 - B^2)$, $\zeta = (k_0^2/8\pi)(\varphi^2 - A^2)$ where $k_0 = 2\pi\mu c/\hbar$. The equation of a non-linear meson field is derived from the variation principle $\delta \int \Theta \, d\omega = 0$. The velocity of small perturbations in the meson field are calculated by the method of characteristics by the Levi-Chelov method of weak discontinuities, or by the method of wave equations. (R.V.J.)

2895

MAGNETIC SUSCEPTIBILITY OF SOME OXALATE COMPLEXES OF QUADRIVALENT URANIUM. T. G. Aminov, V. V. Zelentsov, and I. A. Savich (Moscow Inst. of Physics and Tech.). Doklady Akad. Nauk S.S.S.R. 128, 533-5(1959) Sept. 21. (In Russian)

Magnetic susceptibility of tetravalent uranium was studied in order to determine its electronic configuration. Data are given for the magnetic susceptibility of $U(C_2O_4)_2$ complexes: $K_4\,U(C_2O_4)_4 \cdot 5H_2O$; $Ba_2\,U(C_2O_4)_4 \cdot 6H_2O$; and $Cd_2\,U(C_2O_4)_4 \cdot 7H_2O$. (R.V.J.)

2896

ON THE INTEGRAL EQUATION OF THE SLOWING-DOWN OF NEUTRONS. T. Nakayama and K. Isoda (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 304-7(1959). (In Japanese)

The neutron slowing-down process in an infinite homogeneous medium is analyzed by using the results of the renewal theory. (auth)

2897

CERTAIN TYPES OF NON-LINEAR WAVE EQUATIONS GENERALIZING THE EQUATIONS OF THE THEORY OF PARTICLES WITH SPIN. Gérard Petiau (Institut Henri-Poincaré, Paris). J. phys. radium 20, 784-96(1959) Oct. (In French)

The general formalism of a theory of particles with spin is given where these are specified by spinorial functions which are solutions of systems of non-linear partial differential wave-equations of the first order. The plane wave solutions of these equations are elliptical or hyperelliptical functions of a given type. Examples and complete solutions are given of non-linear equations for unified fields of spin 0 and $\hbar$ or 0 and $\hbar/2$. (auth)

2898

$K^- - K^0$ RELATIVE PARITY DETERMINATION FROM NUCLEON-ANTINUCLEON ANNIHILATION. S. N. Biswas and L. K. Pandit (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 13, 235-8(1959) Oct. (2).

It is suggested that the S_1-violating production process $\bar{p} + n \rightarrow K^- + K^0$ may lead to a definite conclusion whether or not the relative $(K^- - K^0)$ parity is odd. (auth)

2899

PROTONIC DECAY OF A Σ^+ HYPERON WITH AN ASSOCIATED ELECTRON PAIR. Ladislav Rob and Zdeněk Korbel (Charles Univ., Prague). Nuclear Phys. 13, 300-1(1959). Oct. (2).

From a stack of nuclear emulsions irradiated with K^- mesons, a protonic decay of a Σ^+ hyperon with an associated electron pair was observed. A proton energy of 29.4 ± 0.5 Mev was estimated from the range. A π^0-meson emitted in the reaction was estimated to have an energy of 83 Mev. The emitted electron pair was determined to have an energy of 90 Mev by the open angle method and 105 Mev by the dynamics method. (C.J.G.)

2900

STUDY OF THE DIRECT (α, NUCLEON) REACTION, INCLUDING POLARIZATION. Ernest M. Henley (Univ. of Copenhagen and European Council for Nuclear Research, Geneva). Nuclear Phys. 13, 317-32(1959) Oct. (2).

A theoretical study of the differential cross-section and nucleon polarization of the direct (α, N) reaction at medium to high energies is carried out. An expression for the transition matrix element is derived from the distorted wave description, but only the distortion of the α-particle by the nucleus is taken into account in an illustrative calculation. It is argued that experimental studies of the polarization are useful for gaining insight into the reaction mechanism. This is explicitly demonstrated by including the spin-dependence and first order size effects of the interaction responsible for a knock-out process. The reaction examined has several advantages over the similar deuteron stripping process, one of which is the considerably high degree of the nucleon polarization. (auth)

2901

TWO PARTICLE APPROXIMATIONS OF THE MANY BODY PROBLEM. II. W. Brenig (Max-Planck-Institut für Physik und Astrophysik, Munich). Nuclear Phys. 13, 333-49(1959) Nov. (1).

A formulation of the theory of nuclear reactions is presented which exhibits very explicitly the connection between the shell model and the compound nucleus model. A Breit-Wigner formula is derived in which the hard sphere scattering is replaced by the shell model scattering. Although the compound states are in general complicated many-body excitations, the two-particle approximation of Brueckner et. al., can be shown to be sufficient for the calculation of the average properties contained in the optical model. It is proved that the S-matrix, analogous to the ground state energy, could be calculated in a 'model approach' in which the correlations of the target nucleons are taken into account, but the final result is expressed in terms of the momentum distribution of uncorrelated nucleons as in the original Goldberger method. The real and imaginary parts

of the optical potential are calculated and the energy dependence of the so-called rearrangement energy is estimated, resulting in a slight increase of the effective mass. (auth)

2902

ON DIFFRACTIONAL DISINTEGRATION OF DEUTERONS. A. G. Sitenko and V. K. Tartakovskii (Tartakovsky) (Kharkov Univ.). Nuclear Phys. 13, 420-34(1959) Nov. (1).

Diffraction disintegration of deuterons on nuclei is considered under the assumption that the radius of the deuteron is appreciably less than that of the nucleus. A differential cross section of the process is determined, giving the energy distribution of the disintegration products in the deuteron's center-of-mass system and in the laboratory system, their angular distribution, the momentum distribution of the recoil nuclei, and the angular correlation between the disintegration products. The polarization of these particles is likewise considered. (auth)

2903

LOW-TYPE INTEGRAL EQUATIONS FOR THE ABSORPTION AND PRODUCTION OF K MESONS. Saul Barshay (Univ. of Copenhagen). Nuclear Phys. 13, 435-46(1959) Nov. (1).

A discussion is given of Low-type integral equations for approximate transition amplitudes which describe the processes $\bar{K} + N \rightarrow \pi + Y$ and $\pi + N \rightarrow K + Y$. Isobaric spin and angular momentum decompositions of the equations are performed, and the resulting sets of integral equations for the various amplitudes are discussed with non-relativistic approximations for the interaction current operators. Certain assumptions are made with regard to the as yet unknown relative parities, coupling strengths, and scattering properties of the strange particles, in a preliminary effort to utilize the field equations as a model for correlating certain features of the present experimental data on the absorption of low-energy K^- mesons by protons. (auth)

2904

ON A POSSIBLE CONNECTION BETWEEN ISOBARIC SPIN AND STRANGENESS AND INVERSION PROPERTIES OF SPINORS. A. M. Brodskii (Brodsky) and D. D. Ivanenko (State Univ., Moscow). Nuclear Phys. 13, 447-50(1959) Nov. (1).

It is shown how isobaric spin and strangeness properties of particles can be treated by the introduction of an isospace of 2, 3, or 4 dimensions. These properties are also discussed in relation to ordinary pseudo-euclidean space taking into account the behavior of spinors for spatial and temporal inversions and parity non-conservation. (C.J.G.)

2905

PARITY NON-CONSERVATION IN HYPERON DECAYS. Fernando E. Prieto (Univ. of Copenhagen). Nuclear Phys. 13, 456-60(1959) Nov. (1).

The suggestion made by Tati, relating parity conservation or non-conservation to the type of particles involved in the weak interaction vertex responsible for the decay, is examined in the framework of d'Espagnat and Prentki's formalism for strong and weak interactions. It is found that, as long as one considers only second-order effects, the results are in reasonable agreement with the available experimental data, but that, if higher order corrections are considered, serious discrepancies are found with the experimental data on parity non-conservation for the Λ and Σ^- decays in charged pion and a nucleon. (auth)

2906

LEPTONIC DECAY MODES OF K-MESONS AND HYPERONS. N. Cabibbo and R. Gatto (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 13, 1086-1110(1959) Sept. 16.

The decay modes $K \rightarrow \pi$ + charged lepton + ν and $Y \rightarrow N$ + charged lepton + ν are studied by dispersion relation methods. The final spectra for K_3 decays are derived from the solution of an integral equation for the decay amplitude. The methods of solutions for such equations are briefly reviewed. (auth)

2907

ON A RELATION BETWEEN SCATTERING AND PRODUCTION AMPLITUDES. J. Sucher and T. B. Day (Univ. of Maryland, College Park). Nuovo cimento (10) 13, 1111-16 (1959) Sept. 16.

An integral equation is derived which directly exhibits the relation between an amplitude for production, including all interactions, and the corresponding amplitude for complete scattering between the initial particles alone, and between the final particles alone. The only nonmeasurable quantity involved in this relatively simple relation is shown to be an amplitude for pure production in which intermediate states with either the initial particles or the final particles are excluded. (auth)

2908

NOTE ON ANOMALOUS K^+-DECAY EVENTS. K. Hiida (Kyoto Univ.). Nuovo cimento (10) 13, 1117-21(1959) Sept. 16.

The π^+ energy spectrum for the radiative θ^+ decay mode is calculated, and it is shown that the π^+ energy spectrum has no peak at ~60 Mev. Therefore there is no strong evidence to assert that two anomalous K^+ decay events (with a π^- secondary of about 60 Mev) are due more probably to the radiative θ^+ decay mode than to a two-body decay mode: $K^+ \rightarrow \pi^+ + X^0$, where X^0 is a neutral boson with a mass of (500 ± 5) times the electron mass. (auth)

2909

PION-HYPERON SCATTERING. INFLUENCE OF NONSYMMETRIC Λ AND Σ INTERACTION. D. Amati, A. Stanghellini, and B. Vitale (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 13, 1143-55(1959) Sept. 16.

A field theoretical model is developed to study the low-energy pion scattering on Λ or Σ hyperons, taking into account the Λ-Σ mass difference and possible inequality of the coupling constants. From the results it is possible to study the corrections to the prediction of a theory in which Λ and Σ are considered degenerate with respect to pion interactions. These corrections are of the order of the hyperon mass difference over the pion energy and can shift the possible resonances in an appreciable way. It is also briefly discussed which states can present resonances for particular choices of the coupling constants. The relations of the previous results to the K^--N absorption are discussed from a qualitative point of view. (auth)

2910

THE ELECTRON DECAY MODE OF THE PION. J. Ashkin, T. Fazzini, G. Fidecaro, A. W. Merrison, H. Paul, and A. V. Tollestrup (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 13, 1240-62(1959) Sept. 16.

Evidence is presented for the existence of the electron decay mode of the pion. The branching-ratio compared with the normal muon decay, was found to be $(1.22 \pm 0.30) \times 10^{-4}$ for this mode. This is in good agreement with the V–A theory of weak interactions. (auth)

2911

PHOTODISINTEGRATION OF DEUTERONS IN THE PRES-

ENCE OF THE PION-THEORETICAL POTENTIAL. J. Iwadare and R. Tamagaki (Kyoto Univ.); M. Matsumoto (Siga Univ., [Japan]); S. Otsuki (Nagoya Univ., Japan); and W. Watari (Osaka City Univ.). Nuovo cimento (10) 13, 1263-4(1959) Sept. 16.

The validity of the pion-theoretical in the d(γ,p) reaction was studied. Calculations were made for the M1 + E1 transition, using the deuteron wave function determined by the pion-theoretical potential. The agreement of the calculated angular distribution with the experimental one was reasonable. It is concluded that the pion-theoretical potential is theoretically stable in the outer region. (C.J.G.)

2912

APPLICATION OF FIXED ANGLE DISPERSION RELATIONS TO PROTON-PROTON SCATTERING. W. Alles and A. Tomasini (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 13, 1265-7(1959) Sept. 16.

Fixed angle dispersion relations for nucleon–nucleon scattering were applied to proton–proton singlet state scattering to determine the pion–nucleon coupling constant f^2. Low energy p–p scattering fitted only with S_0 wave phase shifts determined $f^2 = 0.082$ which is in good agreement with other determinations. The dependence of f^2 on parameters introduced in the S_0 phase shift equations is studied. (C.J.G.)

2913

APPLICATION OF FIXED ANGLE DISPERSION RELATIONS TO NUCLEON–NUCLEON SCATTERING IN THE TRIPLET STATE. W. Alles and A. Tomasini (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 13, 1273-5(1959) Sept. 16.

The dependence of the pion–nucleon coupling constant f^2 on different values of sin δ (4) and P as applied to nucleon–nucleon scattering in the triplet state was studied. The results seem to indicate $P \simeq -0.04$, however, the residue of the pole is small compared to the values of $f(\omega)$ for $\omega \geq 0$. Although some doubts remain on the validity of the conclusion, the fit of $f(\omega)$ is good. (C.J.G.)

2914

CONSIDERATIONS ON THE CROSS SECTION FOR PION PRODUCTION IN PROTON-PROTON COLLISIONS. E. Ferrari (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 13, 1285-9 (1959) Sept. 16.

The Chew–Low extrapolation method is applied to the cross section for pion production in the processes $p + p \rightarrow n + p + \pi^+$ and $p + p \rightarrow p + p + \pi^0$. It is concluded that process two gives twice as much information for each experimental event. The relation between the moments of the incoming protons and outgoing nucleons and pions is discussed. (C.J.G.)

2915

ON THE GÜRSEY BARYON EQUATION. V. Amar and M. Pauri (Università, Milan and Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 13, 1290-3 (1959) Sept. 16.

An external electromagnetic interaction is introduced into the Gürsey eight-component spinor equation which displays relations between charge independence, baryon conservation, and the Pauli transformation. From the Gürsey equation, and within the limits of doublet-approximation, a pair of second order, two-component relativistic wave equations was obtained which describes all baryons. (C.J.G.)

2916

DETERMINATION OF THE PION-NUCLEON COUPLING CONSTANT FROM PHOTOPRODUCTION ANGULAR DISTRIBUTION. John G. Taylor and Jack L. Uretsky (Univ. of California, Berkeley) and Michael J. Moravcsik (Univ. of California, Livermore). Phys. Rev. 113, 689-94(1959) Jan. 15.

The pion-nucleon coupling constant is determined from the pion photoproduction angular distribution. The method is based upon a certain conjecture concerning the analyticity of the photoproduction amplitude, and does not depend on the validity of any specific theory of photoproduction. It consists of an extrapolation of the angular distribution at any given fixed energy to $\cos\theta = V_\pi^{-1}$, where V_π is the pion velocity divided by the velocity of light. The amplitude at this nonphysical angle has a pole, and the pion-nucleon coupling constant is simply related to the residue of the amplitude. The quartic representation of photoproduction angular distributions is used as the functional form of the extrapolating curve. The most important feature of the new method is in the fact that it measures at least in principle, the pion-nucleon coupling constant at any given fixed energy, while previous determinations in general measure the coupling constant in the low-energy limit, or require assumptions concerning the behavior of the cross section at all energies. The method does not depend on the assumption of charge independence, and measures explicitly the interaction of positive pions with nucleons. The scheme cannot be used for photoproduction of neutral pions. The method is applied to available data at 230, 260, 265, and 290 Mev photon energy in the laboratory system, and an over-all value of $f^2 = 0.064 \pm 0.041$ is obtained. In view of the large error, a detailed discussion is given of possible improvements in experiments which could give a more accurate value. Also discussed is the sensitivity of the value of the coupling constant to various features of the experiment, such as the energy of the photons, the relative importance of the various angles, the relative importance of the relative and absolute normalizations, and the statistical errors on the individual pieces of data. Numerical illustrations are given of the accuracy obtainable for certain given conditions on the factors listed above. (auth)

2917

ENERGY LEVELS OF A BOSE-EINSTEIN SYSTEM OF PARTICLES WITH ATTRACTIVE INTERACTIONS. Kerson Huang (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 115, 765-77(1959) Aug. 15.

An N-body Bose-Einstein system of particles with long-range attraction and hard-sphere repulsion between particles is considered. It is shown that if the constants of the interaction have values within a certain range it is possible to calculate the ground-state energy of the system as a function of Ω/N, where Ω is the volume of the box containing the system, in the limit $N \rightarrow \infty$, $\Omega \rightarrow \infty$, with $N/\Omega = \rho$ fixed. The results show that the system can possess an N-body bound state, which has an equilibrium density and negative energy, and that the interactions can be saturating. Excited states are also considered. It is shown that low-lying excitations consist purely of phonons, whose velocity agrees with that computed from the macroscopic compressibility, furnished by the ground-state energy. The formula for the general excited energy levels suggests that thermodynamically the system may have a "gas" phase and two "liquid" phases, the transition between the two "liquid" phases being the analog of the Bose-Einstein condensation of the ideal gas. (auth)

2918

MOMENT OF INERTIA OF INTERACTING MANY-BODY FERMION SYSTEMS. R. D. Amado and K. A. Brueckner (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 115, 778-84(1959) Aug. 15.

It is shown that the moment of inertia of a noninteracting many-body fermion system moving under periodic boundary conditions has the classical or rigid value when calculated on the "cranking" model of Inglis. By investigating the analogous "pushing" case for the inertial mass we show that the rigid moment can be associated with rigid rotation in spite of apparent surface currents. The effect of particle-particle forces is investigated in the lowest order of perturbation theory. The terms corresponding to a level shift or effective mass are just compensated by other terms and there is no change in the moment of inertia. The possible general validity of these results and their consequence is discussed. (auth)

2919

INELASTIC DIFFRACTION SCATTERING. John S. Blair (Univ. of Washington, Seattle). Phys. Rev. 115, 928-38 (1959) Aug. 15.

The mechanism of inelastic diffraction scattering, introduced by Drozdov and Inopin to discuss scattering from nuclei with quadrupole surface deformation, was extended for scattering amplitude linear in the deformation to arbitrary multipolarity. The resulting angular distributions and gamma-ray angular correlations correspond closely to Born approximation predictions. The model provides a natural explanation for why the inelastic angular distributions of strongly absorbed projectiles are characterized by sharp and persistent oscillations. Comparison is made to observed inelastic scattering of alpha particles and deuterons by light nuclei. Large quadrupole deformations are indicated in many nuclei. The systematic appearance in 4n nuclei of states corresponding to octupole excitation is noted. (auth)

2920

ELASTIC NUCLEON-DEUTERON SCATTERING IN A SOLUBLE MODEL AS A TEST OF THE IMPULSE APPROXIMATION. Thomas Fulton (Johns Hopkins Univ., Baltimore and Philip Schwed (RIAS, Baltimore). Phys. Rev. 115, 973-9(1959) Aug. 15.

A comparison of the results of the Born and impulse approximations for a well-defined situation is made by calculating the nucleon-deuteron differential elastic cross sections in both approximations at incident nucleon laboratory energies of 32, 94, and 146 Mev. In order to carry out the impulse approximation computation in complete detail, including, in particular, contributions from off-energy-shell two-particle matrix elements, the assumption is made that the two-particle scattering is completely described by effective range theory. This assumption, though incorrect, nevertheless retains some of the features of the actual physical situation and provides a means of comparing the results of calculations using the impulse approximation and the Born approximation as well as a way of studying the effect of including two-particle matrix elements off the energy shell. Exact solutions to the two-particle model are written down with the aid of the Gel'fand-Levitan theory and are used in a precise numerical evaluation of the impulse approximation expressions. The results of the Born and impulse approximations differ considerably. Also, indications are that, as expected, the pickup term (which dominates at large angles) is not adequately treated by either of the above approximations. When this term is not considered, a study of the remaining expressions shows that off-energy-shell effects are significant for the deuteron wave functions employed. In view of the rather restrictive assumptions made on the two-particle data, a detailed comparison of the results with experiment is not possible. Nevertheless, there is a suggestion that the impulse approximation, including off-energy-shell effects, describes the experimental results best. (auth)

2921

NEUTRON POLARIZATION IN THE REACTION $D(d,n)He^3$ AT $E_d = 8.2$ Mev. Wilfried W. Daehnick (Washington Univ., St. Louis). Phys. Rev. 115, 1008-10(1959) Aug. 15.

The polarization of neutrons from the reaction $D(d,n)He^3$ was measured at 8.2 Mev incident deuteron energy. By the use of He^4 as a polarization analyzer and a triple coincidence technique systematical errors in the experiment were kept very small, but at a sacrifice in counting rate. Polarization measurements were made at center-of-mass angles of 0°, 47°, and 59°. The values obtained for the neutron polarization and their probable statistical errors are $P(0°) = (-)0.007 \pm 0.007$, $P(47°) = -0.097 \pm 0.060$, and $P(59°) = -0.101 \pm 0.060$. (auth)

2922

MAGNETIC MOMENT OF THE TRITON IN UNITS OF THE MAGNETIC MOMENT OF THE PROTON. William Duffy, Jr. (Stanford Univ., Calif.). Phys. Rev. 115, 1012-14(1959) Aug. 15.

High-resolution nuclear magnetic resonance techniques were used to perform a precise measurement of the ratio of the Larmor frequencies of tritons and protons in a sample of 20% tritiated water. The measured ratio ω_T/ω_H is 1.066 639 75(2). From this frequency ratio and an estimate of the magnetic shielding correction, a value of 1.066 639 86(11) is obtained for the moment of the triton in units of the proton moment. From this value and the hfs measurements of Kusch, and of Prodell and Kusch, one obtains a hfs anomaly of $(-5.62 \pm 0.13)10^{-6}$ for tritium. This observed anomaly is compared with the theoretical predictions of Adams. The longitudinal relaxation time T_1 of the protons and tritons in the sample was measured and found to be 1.02 ± 0.10 sec. and 0.83 ± 0.10 sec., respectively. (auth)

2923

INELASTIC ELECTRON-DEUTERON SCATTERING CROSS SECTIONS AT HIGH ENERGIES. Loyal Durand, III (Inst. for Advanced Study, Princeton Univ., N. J.). Phys. Rev. 115, 1020-38(1959) Aug. 15.

The effects on the cross sections for the inelastic electron-deuteron scattering process $e + d \rightarrow e + n + p$ of interactions between the outgoing nucleons are examined in detail. The cross sections are calculated in the first Born approximation with respect to the electromagnetic interaction using nucleon wave functions modified by the final state interactions. Crude estimates indicate that the peak value of the cross section $d^2\sigma/(d\Omega_e dE_{e'})$ may be decreased by ~5 to 10% in the presence of such interactions. It is shown that additional decreases of ~5% will result when proper account is taken of the D-state component of the deuteron wave function. These changes in the cross section affect appreciably the determination of the neutron magnetic form factor from the experimental scattering cross sections. A new method of measuring the magnetic form factor based on the angular distribution of the outgoing nucleons is therefore proposed which eliminates almost all the uncertainties relating to the deuteron wave function and the effects of final state interactions. This method may also be used in conjunction with the depend-

ence of the cross sections on the electron scattering angle to study the behavior of the neutron charge form factor in the region of large momentum transfers. The polarization of the outgoing nucleons is also calculated. While significant information may in principle be obtained from polarization measurements, the required experiments do not appear to be feasible at the present time. The modifications of the cross sections resulting from relativistic effects are considered, and some uncertainties inherent in previous work are clarified. (auth)

2924

PHOTOPRODUCTION OF K^+ MESONS. B. D. McDaniel, A. Silverman, R. R. Wilson, and G. Cortellessa (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 115, 1039-48(1959) Aug. 15.

The photoproduction in hydrogen K^+ mesons in association with hyperons was studied using an 1160-Mev bremsstrahlung beam from the Cornell Synchrotron. The K mesons were selected with a magnetic analyzer and counter telescope system. They were further identified by bringing them to rest in a stopping block and by the detection of the particles arising from their decay. The angular distribution for the associated production of K^+ mesons with Λ^0 hyperons at the photon energies of 980 and 1010 Mev was studied. Measurements were also made of the cross section as a function of photon energy for the center-of-mass angle of 85 degrees. The results of these measurements are compatible with S-wave production. The photoproduction of Σ^0 hyperons in association with K^+ mesons was measured for one set of kinematical conditions. The measured $(K^+ - \Sigma^0)$ cross section is comparable to that of the $(K^+ - \Lambda^0)$ process. (auth)

2925

NUCLEAR INTERACTION OF θ_2 MESONS IN EMULSION. U. Camerini and W. F. Fry (Univ. of Wisconsin, Madison) and M. Baldo-Ceolin, H. Huzita, and S. Natali (Universita, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Phys. Rev. 115, 1048-52(1959) Aug. 15.

Observations in emulsion on the nuclear interaction of neutral K mesons are reported. A total of 1 τ^+, 7 K^-, 7 Σ^+, 10 Σ^-, and 18 hyperfragments were observed. The relative frequencies of different types of strange particles produced in the emulsion are consistent with the assumption that the neutral K meson is a particle admixture and that interactions in the θ and $\bar{\theta}$ modes are similar to interactions of K^+ and K^-, respectively. (auth)

2926

GREEN'S FUNCTION APPROXIMATION METHOD. I. THE NUCLEON. David S. Falk (Harvard Univ., Cambridge, Mass.). Phys. Rev. 115, 1069-73(1959) Aug. 15.

A method for the approximate construction of the nucleon Green's function is presented. The development is such that the approximate Green's function automatically has the same analytical properties as the exact one. This method involves the symmetrical treatment of the Green's function and, ultimately, the assumption that certain particles behave in an uncorrelated manner. The approximation results in a linear integral equation for the Green's function which is completely renormalized. This equation is solved exactly through the use of the spectral representation which, by construction, is consistent with the approximation. (auth)

2927

GREEN'S FUNCTION APPROXIMATION METHOD. II. POLARON. David S. Falk (Harvard Univ., Cambridge, Mass.). Phys. Rev. 115, 1074-8(1959) Aug. 15.

A method previously derived for the approximate construction of the nucleon Green's function is applied to that of the polaron. After making an arbitrary translation of the phonon variables, a linear integral equation for the Green's function is derived by means of a symmetrical treatment and a noncorrelation assumption, in complete analogy to the nucleon problem. This equation is solved through the introduction of a spectral representation in the special case of zero total momentum. The lowest energy state of the system is calculated in terms of the arbitrary translations and then minimized with respect to them. Using the simplest nontrivial cutoff procedure to obtain the variational equation and its solution, results are obtained for values of the coupling parameter $\alpha \leq 3$, and are compared with those of Feynman. (auth)

2928

RELATIVISTIC THEORY OF UNSTABLE PARTICLES. II. P. T. Matthews and Abdus Salam (Imperial Coll., London). Phys. Rev. 115, 1079-84(1959) Aug. 15.

It is shown that the spectral function $\rho(m^2)$ appearing in the (field-theoretic) one-particle propagator has a direct significance as the probability of finding in production an unstable particle of mass m. This allows definition of a "one-particle" state for the unstable particle as a superposition of its outgoing decay states suitably weighted in mass space [with a factor which is the square-root of $\rho(m^2)$]. The proper-time propagation of this state gives the decay amplitude, and its modulus is ideally the experimentally observed decay-time plot. The time plot is explicitly evaluated for π decay. Insofar as the distribution of mass values for the π meson starts with the μ mass (assumed stable), the time plot is not merely the conventional decay exponential $e^{-\tau/\tau_0}$. There are additional terms which become important about a hundred lifetimes after the particle is created. A comparison is made between the time plots for particle and antiparticle decays on the basis of CTP invariance. (auth)

2929

WEAK-COUPLING EXPANSION FOR THE GROUND-STATE ENERGY OF A MANY-BOSON SYSTEM. M. Girardeau (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 115, 1090-4(1959) Sept. 1.

The pair theory of many-boson systems is used to obtain a weak-coupling expansion for the ground-state energy to third order in the coupling constant. The relationship of this expansion to the formal Rayleigh-Schroedinger perturbation expansion is discussed, with particular reference to the relationship between the divergent third-order term in the formal perturbation expansion and the terms of $^5/_2$ and third orders in the correct weak-coupling expansion. The excitation energy is discussed and it is pointed out that the lowest-order "nonpair" correction to the phonon energy is of the right order of magnitude to cancel the spurious energy gap of the pair theory. (auth)

2930

PROTON-PROTON SCATTERING AT 90° FROM 28 to 68 Mev. Lawrence H. Johnston and Yung Su Tsai (Univ. of Minnesota, Minneapolis). Phys. Rev. 115, 1293-4(1959) Sept. 1.

Proton-proton scattering cross sections are measured at 45° in the laboratory system, from 28 to 68 Mev, with an accuracy of about ±1.2%. These measurements fill the energy gap between the work of Cork on the low-energy end, and that of Ramsey et al. at higher energies. In the region of overlap with these experiments there is

reasonable agreement. The cross section falls monotonically with increasing energy. (auth)

2931

CHARGE EXCHANGE SCATTERING OF 128-Mev NEGATIVE PIONS ON HYDROGEN. E. Garwin, W. Kernan, C. O. Kim, and C. M. York (Univ. of Chicago, Ill.). Phys. Rev. 115, 1295-9(1959) Sept. 1.

The charge exchange scattering of negative pions by liquid hydrogen was measured at 128 ± 2 Mev bombarding energy. A lead-glass Čerenkov counter was used to measure the energy spectrum of the gamma rays emitted in the decay of the neutral pions. The gamma rays were detected at four angles relative to the incident beam: 45, 80, 116, and 135°. The integrated cross section is $\sigma_{tot}(\pi^-,\pi^0) = 25.6 \pm 1.3$ mb, which is in good agreement with other work. (auth)

2932

USEFUL SYMMETRIES OF STRONG INTERACTIONS. J. J. Sakurai (Inst. of Advanced Study, Princeton, N. J.). Phys. Rev. 115, 1304-9(1959) Sept. 1.

An attempt is made to deduce "useful" relations among strange particle reactions slightly stronger than those implied by charge independence in the conventional sense. As Pais has shown, there are no such relations that hold to all orders aside from those already contradicted by experiments. However, for the relative ΛΣ parity even and $G_{K\Lambda N} = (\pm)G_{K\Sigma N}$, $G_{K\Sigma\Lambda} = (\pm)G_{K\Sigma\Sigma}$, there exist relations that are valid as long as virtual pions play no role. In addition, $G_{\pi\Lambda\Sigma} = (\mp)G_{\pi\Sigma\Sigma}$ (which means that the π couplings and the K couplings exhibit opposite four-dimensional symmetries), the weaker condition that pions emitted by N and Ξ (Λ and Σ) be not absorbed by Λ and Σ (N and Ξ) is sufficient for the validity of such relations. Empirical examples are given. The question of the baryon mass spectrum is discussed. (auth)

2933

MESON-MESON SCATTERING TERM IN PSEUDOSCALAR-PSEUDOSCALAR MESON THEORY. M. Sugawara (Purdue Univ., Lafayette, Ind.) and A. Kanazawa (Hokkaido Univ. Sapporo). Phys. Rev. 115, 1310-17(1959) Sept. 1.

The meson-meson scattering term was investigated within the static approximation for a nucleon. First a static Hamiltonian is constructed from the renormalizable covariant meson theory. The meson-meson scattering term is included besides the pseudoscalar-pseudoscalar coupling term and an argument is presented to show that the Foldy transformation is the unique one generating a valid static Hamiltonian, though it was left undetermined before. The resulting static Hamiltonian is then analyzed, for the cases of low-energy S- and P-wave pion-nucleon scattering and threshold photomeson production, in terms of the one-meson approximation of the Chew-Low-Wick formalism, without recourse to perturbation expansion. It is shown in particular that the meson-meson scattering term modifies the Chew-Low effective range plot of the δ_{33}-phase shift, making the renormalized P-wave coupling constant smaller than the conventional plot gives, for a positive coefficient of the meson-meson scattering term in the Hamiltonian. Empirical values of the coupling constant determined through the conventional Chew-Low plot and threshold photomeson extrapolation are shown to be interpretable in terms of the renormalized P-wave coupling constant of 0.08 and the meson-meson scattering term with a coefficient of $\approx +4$ ($\hbar = c = 1$). The present treatment of threshold photoproduction of mesons, however, does not agree with the relativistic dispersion relation. General features of the static model resulting from the pseudoscalar meson theory are summarized. The effects of strange particles and of renormalization were neglected. (auth)

2934

PION-PION INTERACTION IN τ^+-MESON DECAY. Billy S. Thomas and W. G. Holladay (Vanderbilt Univ., Nashville). Phys. Rev. 115, 1329-30(1959) Sept. 1.

The deviations of the π^- spectrum in τ^+-meson decay from the Dalitz-Fabri distribution in the 0^- state are analyzed on the assumption of a $\pi^+ - \pi^+$ short-range interaction. Agreement with experiment is found if the absolute value of the $\pi^+ - \pi^+$ scattering length $|a|$ is 1.4×10^{-13} cm. The π^+ spectrum is also calculated on the basis of this scattering length and is found to agree with the experimental results. (auth)

2935

ANOMALOUS MAGNETIC MOMENTS OF BARYONS IN A STATIC CUTOFF PERTURBATION THEORY. W. G. Holladay (Vanderbilt Univ., Nashville). Phys. Rev. 115, 1331-4(1959) Sept. 1.

A universal coupling between pions and baryons should lead to anomalous moments comparable in magnitude for all the baryons except for the Λ and Σ^0 whose anomalous moments for reasons of isotopic spin symmetry should receive no direct contribution from the pion field. To estimate the influence of the K-mesonic field on these moments, a static cutoff second-order perturbation calculation is made on the assumption that all baryons have spin ½ and the same parity, that the K meson is a pseudoscalar, and that the K-mesonic interaction with the baryons is charge independent. Along the same lines a fourth-order calculation of the pionic contributions to these moments is also made. Baryon currents are neglected in these calculations and cutoff momenta based on the rest mass of the baryon emitting the meson were uniformly used for all processes. The Λ and Σ^0 moments are negative with a value of only about 0.5 nuclear magnetons even if the K-meson coupling constants are large and judiciously chosen, a value which is therefore indicated as an upper limit, if no special enhancement effect is considered. If the K-meson couplings are all considerably smaller than the universal pion baryon coupling, then the Λ and Σ^0 moments are quite small but the other hyperons have moments of comparable magnitude as is generally to be expected. If all K-coupling constants are large, our considerations show that p, n, Σ^+, and Ξ^- may still have comparable anomalous moments but the Σ^- is indicated to have a somewhat larger and the Ξ^0 a somewhat smaller moment than these. A pion coupling to the hyperons different from that to the nucleons would manifest itself in characteristic ways in terms of anomalous magnetic moments, for large or small values of the K-coupling constants. (auth)

2936

EXPERIMENTAL EVIDENCE FOR D WAVES IN π^--p SCATTERING AT 370 AND 427 Mev. Lester K. Goodwin, Robert W. Kenney, and Victor Perez-Mendez (Univ. of California, Berkeley). Phys. Rev. Letters 3, 522-4(1959) Dec. 1.

The total elastic cross sections for π^--p scattering are 10.8 ± 0.2mb at 370 Mev and 13.00 ± 0.34 mb at 427 Mev. The zero-degree differential cross sections obtained by extrapolation best fit data to O^0 and using only S- and P-wave contributions (n = 2) are 1.38 ± 0.23 mb/sterad at 370 Mev and 1.78 ± 0.55 mb/sterad at 427 Mev. The probabilities that the experimental data are consistent with the fits based on S and P waves alone is less than 1% which shows that the inclusion of D waves is necessary to obtain

a reasonable fit to the data. It is concluded that D waves are present and F waves may be present, especially at 427 Mev. (C.J.G.)

2937

PARITY OF THE NEUTRAL PION. R. Plano, A. Prodell, N. Samios, M. Schwartz, and J. Steinberger (Columbia Univ., New York). Phys. Rev. Letters 3, 525-7(1959) Dec. 1.

A study of certain angular correlations in the decay $\pi^0 \rightarrow 2e^+ + 2e^-$ is given. A total of 79 events of π^0 production in the captive reaction $\pi^- + p \rightarrow \pi^0 + n$ are analyzed. The effective frequency distribution was found to be -0.75 ± 0.42 by experiment and ± 0.48 theoretically, where the plus and minus sign refer to even and odd parity, respectively. It is concluded that the neutral pion is pseudoscalar. (C.J.G.)

2938

TRANSFORMATION OF MUONS INTO ELECTRONS. G. Feinberg (Columbia Univ., New York); P. Kabir (Inst. for Nuclear Physics, Calcutta), and S. Weinberg (Univ. of California, Berkeley). Phys. Rev. Letters 3, 527-30(1959) Dec. 1.

It is shown for a certain class of interactions which might be expected to induce μ-e transformations that the similarity of the μ and e actually forbids the transformations. (C.J.G.)

2939

ON THE THEORY OF THE SUPERFLUID STATE OF A SYSTEM OF FERMI-PARTICLES WITH ISOTOPIC SPIN. [PART] I. B. B. Dotsenko (Inst. of Physics, Academy of Sciences, Ukrainian RSR). Ukrain. Fiz. Zhur. 4, 300-12 (1959) May–June. (In Ukrainian)

The energy states of a system of Fermi particles having both spin and isotopic spin—i.e., of the nuclear matter—are considered, employing the methods of N. N. Bogolyubov. The lowest energy state of this system is found to be a superfluid state. There is an energy gap between this state and the normal state. The energy of one-fermion excitation is also found; it is separated from the ground superfluid state by the energy gap. The case when the Fermi energy of protons differs from that of neutrons is discussed. (auth)

2940

ANGULAR DISTRIBUTION OF ELASTICALLY SCATTERED PROTONS. N. N. Pucherov (Inst. of Physics, Academy of Sciences, Ukrainian RSR). Ukrain. Fiz. Zhur. 4, 313-17(1959) May–June. (In Russian)

The methods and results of measurements of the angular distribution of elastically scattered 6.8 Mev protons are given in a wide mass number range. The angular distributions show the same general trend as in the higher energy region. (auth)

2941

ON THE ANGULAR DISTRIBUTION OF ELASTICALLY SCATTERED 6.8 Mev PROTONS ON NUCLEI WITH Z = 26–30. N. N. Pucherov (Inst. of Physics, Academy of Sciences, Ukrainian RSR). Ukrain. Fiz. Zhur. 4, 318-21(1959) May–June. (In Ukrainian)

Results are given of angular distribution measurements of elastically scattered 6.8 Mev protons by Fe, Co, Ni, Cu, and Zn. The distributions for Fe and Ni with large angles show a scattering different from that of other elements. Possible explanations of the effect are considered. (auth)

2942

THEORY OF HYPERNUCLEI. D. D. Ivanenko, V. A. Lul'ka, and V. A. Filimonov. Uspekhi Fiz. Nauk 68, 663-85(1959) Aug. (In Russian)

A short theoretical survey and basic experimental data on hypernuclei are presented. 136 references. (R.V.J.)

2943

SECONDARY STARS CREATED IN THE INTERACTION BETWEEN 8.7 Bev PROTONS AND PHOTOGRAPHIC EMULSION NUCLEI. G. B. Zhdanov, P. K. Markov, V. N. Strel'tsov, M. I. Tret'yakova, P'u-ying Chêng, and M. G. Shafranova (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 611-15(1959) Sept. (In Russian)

Secondary interactions involving fast neutrons, protons, and π mesons produced in a photographic emulsion stack by 8.7 Mev proton bombardment were studied. It was found that on the average 0.68 ± 0.07 fast neutrons per star are produced. Fast nucleons carry off $(55 \pm 9)\%$ and fast π mesons $(33 \pm 9)\%$ of the primary nucleon energy. (auth)

2944

NUCLEAR INTERACTIONS OF 8.7 Bev PROTONS IN PHOTOGRAPHIC EMULSIONS. G. B. Zhdanov, V. M. Maksimenko, M. L. Tret'yakova, M. N. Shcherbakova (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 37, 620-33(1959) Sept. (In Russian)

Inelastic interaction between 8.7-Bev protons and photographic emulsion nuclei and in particular the interaction cross section, multiplicity of the generated particles, and their angular distribution were investigated. From comparison with computations based on the statistical theory some conclusions regarding the existence of interactions of the peripheral (nucleon–nucleon) type are made as well as conclusions on the role of secondary interactions inside a composite nucleus. (auth)

2945

SCATTERING OF 5-10 Mev PROTONS ON He^3. K. P. Artemov, S. P. Kalinin, and L. N. Samoĭlov. Zhur. Eksptl'. i Teoret. Fiz. 37, 663-6(1959) Sept. (In Russian)

The angular distribution of protons elastically scattered on He^3 is measured for five values of the initial energy. The protons were recorded by their tracks in the photographic plates. The differential scattering cross sections thus obtained are compared with the theoretical ones computed under two different assumptions regarding the nature of exchange forces. Serber's type of the nucleon–nucleon interaction more satisfactorily agrees with the experimental data. Discrete levels in the Li^4 nucleus are not apparent from the energy dependence of the cross section. (auth)

2946

DISPERSION RELATIONS FOR THE VIRTUAL COMPTON EFFECT. I. S. Zlatev and P. S. Isaev (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 728-34(1959) Sept. (In Russian)

Dispersion relations for physical amplitudes were derived by the Bogolyubov method in the c.m.s. for electron bremsstrahlung on a nucleon and pair production by γ quanta on a nucleon in the lowest approximation in e. (auth)

2947

ANGULAR DISTRIBUTION AND POLARIZATION OF β-PARTICLES IN SECOND FORBIDDEN TRANSITIONS. A. Z. Dolginov and E. V. Kharitonov. Zhur. Eksptl'. i Teoret. Fiz. 37, 776-85(1959) Sept. (In Russian)

Explicit formulas are derived for the polarization and angular distribution of β electrons in second forbidden transitions involving V and A coupling. The angular correlation in unique transitions is examined for the case of

an arbitrary order of forbiddeness. Unique second forbidden transitions are treated in detail. (auth)

2948

PAIR PRODUCTION IN COLLISIONS BETWEEN CHARGED PARTICLES. F. F. Ternovskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 793-8(1959) Sept. (In Russian)

Pair production due to collisions between fast charged particles and atoms is considered. Expressions for the cross sections are obtained which are valid for positron and electron energies comparable with that of the mother particle. (auth)

2949

THE ELECTROMAGNETIC MASS OF K-MESON. Chou Kuan-chao and V. I. Ogievetskiĭ (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 866-7(1959) Sept. (In Russian)

It is postulated that K^+ and K^0 from a charge doublet and the magnitude $M_{K^0} - M_{K^+}$ can be explained by electromagnetic interactions. (R.V.J.)

2950

THE POLARIZATION OF ELECTRONS IN PRESENCE OF BREMSSTRAHLUNG. A. A. Kresnin. Zhur. Eksptl'. i Teoret. Fiz. 37, 872-3(1959) Sept. (In Russian)

The changes in the electron beam polarization caused by bremsstrahlung are analyzed. (R.V.J.)

2951

ISOSPIN AND STRANGENESS RELATIONSHIP TO SPINOR BEHAVIOR IN MASS REVERSAL. A. M. Brodskiĭ and D. D. Ivanenko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 876-7(1959) Sept. (In Russian)

Isotopic and strange properties are described within the limits of ordinary space by utilizing probabilities of distinct behaviors of spinors in mass reversal and considering the non-conservation of the even parity. (R.V.J.)

Nuclear Properties and Reactions

2952 AECU-4462

Duquesne Light Co., Shippingport, Penna.

PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "A" SURVEY. SECTION I. FOURTH PERFORMANCE. CORE I – SEED I. Test Results DL-S-184 (T-612076). First Issue, Oct. 22, 1959. 8p. OTS.

The radiation level in the boiler compartment was determined using Channel 5 of the operational radiation monitoring system and was found to be relatively low following reactor shutdown. (J.E.D.)

2953 AECU-4465

Duquesne Light Co., Shippingport, Penna.

XENON TRANSIENT. SECTION I. 1692.8 EFPH. SECOND PERFORMANCE. CORE 1, SEED 1. Test Results DL-S-156 (T-612081). First Issue, Oct. 27, 1959. 24p. OTS.

Tests indicated that after 1692.8 EFPH of plant operation the excess reactivity of the core was sufficient to override peak xenon with rod groups I and II withdrawn to approximately 69 in. and group III withdrawn to approximately 51 in. The override of peak xenon occurred 8 hr and 51 min after shutdown, where the time of shutdown was considered the time when the turbine throttle was tripped. (auth)

2954 AECU-4470

Ohio State Univ. Research Foundation, Columbus.

SCATTERING STUDIES WITH THE OHIO STATE UNIVERSITY CYCLOTRON. Annual Report for the Period October 1, 1958–September 30, 1959. (Report No. 3). H. J. Hausman. Sept. 23, 1959. 74p. RF Project 735. Contract AT(11-1)-503. OTS.

Apparatus used in scattering experiments conducted during the report period are described. Included are discussions of the scattering system, and design of the 7000 lb double-focusing spectrometer magnet. Nuclear resonance field measurements of hydrogen and lithium are also described. Results of calibration counting rate versus magnetic field using 5.3 Mev Po alpha particles is presented graphically along with data on protons scattered from Al at 90°. Remote control for the rotating counter is described and the design of a coincidence circuit for protons is given along with data on coincidence counts of protons scattered from gaseous neon. Preparations of targets including Cr, Fe, Li, Na, S, V, gas targets and self supported quartz, foil and self supported evaporated targets are described. Angular correlations data on the first excited states of Li^6, Li^7, C^{12}, Ne^{20}, Al^{27}, Si^{28}, S^{32}, and Cr^{52} are reported. Some exploratory angular correlation experiments were also conducted on Na^{23}, Fe, and V^{51} are reported as well as preliminary alignment experiments which were done to ensure that no asymmetries in the angular correlations measured were induced by geometrical misalignments. Experimental procedures are described and discussions of results and conclusions are presented. (For preceding period see AECU-3885.) (J.R.D.)

2955 AECU-4487

General Atomic Div., General Dynamics Corp., San Diego, Calif.

ESTIMATION OF EFFECTIVE CROSS SECTIONS FROM WESTCOTT'S CORRELATION IN AECL-407. T. H. Pigford. Mar. 19, 1958. 8p. Project 40. (GAMD-306). OTS.

A brief summary and derivation of the working equations to use with Westcott's tabulation of g and s values in AECL-407 are given. Westcott's data provide a means of estimating the effective "thermal" cross sections for well-moderated thermal reactor spectra. These cross sections take into account both thermal and non-thermal contributions to the reaction rate. The effective η of U^{235} is estimated as an example. (W.D.M.)

2956 APEX-530

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

URANIUM-235 FISSION PRODUCT ACTIVITY AND ENERGY AS A FUNCTION OF DECAY TIME FOR A SPECIFIC IRRADIATION TIME AND THERMAL FLUX. C. B Magee. Apr. 1959. 21p. Contract AF33(600)-38062 and AT(11-1)-171. OTS.

The activity and beta minus power of the individual radioactive fission products are given as a function of cooling time up to about 30 hr for an irradiation time and thermal neutron flux that approximate conditions in a one-week irradiation in the Low Intensity Test Reactor (LITR). The recent compilation of Blomeke and Todd was used for the most part to obtain concentrations of individual nuclides. Totals of activity and β^- power have been obtained from the values for the individual fission products, and these totals are compared in graphical form to similar totals given by Blomeke and Todd. Comparison is made also to totals of total power and gamma power given by Blomeke and Todd and to a modified Way-Wigner expression which is reported to represent either the γ or β^- power within a factor of 2 for cooling times from 10 seconds to 100 days. For cooling times beyond 30 hours the total quantities of Blomeke and Todd are compared to the

same Way-Wigner expression. Some conclusions based on these comparisons are given at the end of Part II. (auth)

2957 CRD-R-31(and Add.)
California Research and Development Co., Livermore, Calif.
UNCLASSIFIED CROSS SECTIONS FOR FAST REACTOR CALCULATIONS. F. E. Bjorklund. Jan. 20, 1953. Includes Addendum. 18p. OTS.

A compilation of estimated capture and total cross sections is given for 47 elements. Transport and inelastic cross sections are tabulated for various elements and curves of these cross sections vs. pertinent nuclear properties are given. (C.J.G.)

2958 CU-188
Columbia Univ., New York.
ELASTIC SCATTERING OF ALPHA PARTICLES BY N^{15} (thesis). Herman H. Smotrich. Apr. 10, 1959. 106p. Contract AT-30-1-GEN-72. OTS.

Elastic scattering of alpha particles by N^{15} at 1.75 to 5.49 Mev was investigated. Thirty resonances corresponding to levels in F^{19} were observed. Data on energy levels found through $N^{15}(\alpha,\alpha)N^{15}$ as well as data from similar experiments are presented graphically along with data from a phase shift analysis of the cross section curve from 1.85 to 4.00 Mev. Values for resonant energies, spins, parities, and reduced widths of the levels in this range were obtained. Values for the excitation energy and the eigenenergy are given with respect to the F^{19} ground state. The assignment of spins and parities to the lower levels in F^{19} is suggested by the reaction $N^{15}(\alpha,\gamma)F^{19}$. From this information it is possible to check the validity of the shell and rotational model calculations. (J.R.D.)

2959 NAA-SR-4418
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CALCULATION OF THE EFFECTIVE RESONANCE INTEGRAL OF U^{238}. A. R. Vernon. Nov. 15, 1959. 22p. Contract AT-11-1-GEN-8. OTS.

Methods for determining an effective resonance integral from available resonance parameter data are examined and applied to lumped systems where the absorber is U^{238}. Agreement with experiment is satisfactory in view of an uncertainty of about 10% introduced by probable errors of the parameter data. The empirical formula $I = a\sqrt{S/M + b}$ is expected to represent the geometric behavior of I better than other two-parameter formulas, when applied to a variety of fuel element compositions. For uranium metal, the formula is virtually indistinguishable from the formula of Gurevich and Pomeranchouk: $I = A\sqrt{S/M + B}$. Quantitative results describing the temperature and energy dependence of resonance captures are also given. (auth)

2960 NAA-SR-Memo-2420
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
NUCLEAR PARAMETER SURVEY OF 100 EMW OMR. W. D. Leggett. Jan. 13, 1958. 6p. OTS.

Studies were performed to determine the variation of K_{eff} in a 100 Mw(e) OMR with temperature and enrichment for various fuel element sizes, maintaining the same amount of moderator inside the fuel element for all element sizes. For all cases considered the fuel element was located in a 6-in. by 6-in. unit cell. Fuel element sizes below 4.0 in. gave a positive temperature coefficient of reactivity. The rise of K_{eff} with enrichment is practically linear for all element sizes. (W.L.H.)

2961 NAA-SR-Memo-2502
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
STRESS ANALYSIS OF THE OMR CORE VESSEL SUPPORT STRUCTURE. Charles Peinado. Feb. 24, 1958. 34p. OTS.

Studies were made to determine the stress equations necessary for the design and analysis of the OMR Core Vessel Support Structure. A parameter study of these equations applicable to the present core vessel design was also made. (W.L.H.)

2962 NAA-SR-Memo-3013
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MULTIGROUP CROSS SECTIONS FOR U^{234}, U^{236}, AND Th^{232}. Von E. Kistler. Aug. 21, 1958. 6p. OTS.

The effective 32 group absorption cross sections for Th^{232}, U^{234}, and U^{236} were determined and are tabulated. The energy limits of the 32 groups chosen are also presented. The calculations account for the shelf shielding and Doppler broadening effects on the resonance absorptions. (W.L.H.)

2963 NAA-SR-Memo-4060
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
300 eMW OCR POWER SHAPING ROD POISON MATERIAL. R. W. Hardy. July 2, 1959. 9p. OTS.

Studies were performed to optimize the poison material in the power shaping rods of the 300 Mw(e) OCR for minimum annual cost. The following poison materials were investigated; Eu_2O_3, Sm_2O_3, Gd_2O_3, Dy_2O_3, dispersed in stainless steel, and B^{10} stainless steel alloys. The economic comparison of these materials is presented. (W.L.H.)

2964 NAA-SR-Memo-4380
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MARITIME OMCR BURNUP STUDY. R. W. Hardy and R. Tanaka. Sept. 15, 1959. 4p. OTS.

The radial power distribution, core reactivity, isotope buildup, U^{235} atom % enrichment, and Pu concentration in the Maritime OMCR core were determined as a function of burnup. (W.L.H.)

2965 NP-8032
Tokyo Univ. Inst. for Nuclear Study.
REACTIONS OF ARGON-40 WITH ALPHA-PARTICLES. Shigeo Tanaka, Michiaki Furukawa, Takashi Mikumo, Shiro Iwata, Masuo Yagi, and Hiroshi Amano. [1958]. 13p.

Excitation functions for the (α,p) and (α,pn) reactions on Ar^{40} were measured by the activation method using a "modified stacked-foil" technique. The bombardments were made with an alpha-particle beam from the 160 cm INSJ cyclotron. The beam was collected in a Faraday cup and measured by a current integrator. The disintegration rates of product nuclei were determined by $4\pi\beta$-counting. The results were compared with the predictions based on the statistical model of nuclear reaction. The fits with theory are fairly poor for the magnitudes of cross section, the predicted values being considerably too large. The excitation function for the (α,p) reaction decreases rather slowly above the separation energy of a secondary particle emission. These behaviors may suggest a significant contribution of some reaction mechanism without passing through the compound nucleus formation process. (auth)

2966 NP-8033
Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab.
ANGULAR CORRELATION STUDY OF THE $Mg^{24}(d,p\gamma)Mg^{25}$ STRIPPING REACTION AS A TEST OF THE DISTORTED WAVE THEORY (thesis). Technical Report No. 1 [on]

PRECISION SCATTERING OF NUCLEAR PARTICLES. Joseph Pourcher Martin. Oct. 1959. 66p. Project NR024-068. Contract Nonr-624(10).

Angular correlations between protons from the $Mg^{24}(d,p)Mg^{25}$ reaction leading to the 3.40-Mev excited state of Mg^{25} and the resulting de-excitation gamma rays were investigated to test the validity of the distorted wave stripping theory. A natural magnesium target was bombarded by 15-Mev deuterons and proton-gamma coincidences were counted using scintillation detectors in conjunction with conventional fast-slow coincidence circuitry. The correlations at 15 and 45° were in good agreement with the predictions of the distorted wave theory. (W.D.M.)

2967 NP-8037

Pennsylvania. Univ., Philadelphia.

STUDIES IN PHOTONUCLEAR REACTIONS. Annual Report. Oct. 15, 1959. 15p. Contract AF49(638)-454.

The new betatron control system was calibrated using thresholds for photoneutrons from D, Bi, Cu, and for the isochromat from the 15.12 Mev level in carbon. A total of 73 photoneutron thresholds was measured throughout the periodic table with an average accuracy of the order of 50 kev. The activation curves for C, N, O, and F were analyzed to yield the (γ,n) cross section in the neighborhood of threshold. (W.D.M.)

2968 ORNL-1835

Oak Ridge National Lab., Tenn.

AIRCRAFT REACTOR TEST HAZARDS SUMMARY REPORT. W. B. Cottrell, W. K. Ergen, A. P. Fraas, F. R. McQuilkin, and J. L. Meem. Jan. 19, 1955. Decl. Oct. 9, 1959. 156p. Contract W-7405-eng-26. OTS.

The ART is to be a 60-Mw reflector-moderated circulating-fuel type whose basic design is suitable for use in aircraft. The new principle of design introduced in the ART consists of circulating the fuel through the reactor in a single, thick, annular passage and achieving the major portion of the moderation with a Be reflector which will also serve as an important portion of the shield. Descriptions are given of the reactor, reactor cell, test site, reactor controls, and operating plan. Three major categories of hazards are considered: accidents with an appreciable probability of occurring, accidents causing rupture of the pressure shell, and accidents causing rupture of the reactor cell. (W.D.M.)

2969 ORNL-2790

Oak Ridge National Lab., Tenn.

SCINTILLATION SPECTROSCOPY MEASUREMENTS OF GAMMA-RAY ENERGIES FROM SOURCES OF Y^{88}, Mn^{54}, AND Zn^{65}. R. W. Peelle and T. A. Love. Nov. 20, 1959. 34p. Contract W-7405-eng-26. OTS.

A series of experiments employing NaI(Tl) scintillation spectroscopy techniques was performed to determine the energies of the strong gamma rays in the decays of Y^{88}, Mn^{54}, and Zn^{65}. A variety of calibration sources and counter geometries was used, including some which employed coincidence techniques to observe "double-escape" peaks corresponding to the loss of $2m_ec^2$ from the scintillator. Care was taken to avoid effects from drifts and to correct for nonlinearities of the system. The average gamma-ray energies measured are (1.840 ± 0.002) Mev and (0.8988 ± 0.0012) Mev for Y^{88}, (0.8347 ± 0.0011) Mev for Mn^{54}, and (1.114 ± 0.004) Mev for Zn^{65}. These values are consistent with averages of published values, but the quoted errors are smaller except in the case of Zn^{65}. When values were deduced for already well-known energies of other gamma-ray transitions, discrepancies between the present measurements and accepted values were consistent with quoted errors. (auth)

2970

AN UPPER LIMIT FOR THE VAPOUR PRESSURE OF BISMUTH (ThC) AT ROOM TEMPERATURE. J. S. Auslländer, V. Labău, and St. Meitert. Acad. rep. populare Romîne, Inst. fiz atomică şi Inst. fiz. Studii cercetări fiz. 10, 229-34(1959). (In Rumanian)

The vapor pressure of Bi(ThC) at room temperature was determined by a photographic method previously described as being of approximately 10^{-17} mm Hg. It is certainly smaller than $6 \cdot 10^{-17}$ mm Hg. (auth)

2971

DETERMINATION OF THE ISOTOPIC PURITY BY MEASUREMENT OF THE HALF-LIFE OF Au^{198}. L. Grigorescu and P. Sandru. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 366-8(1959). (In Rumania)

In order to use Au^{198} as a standard, a critical evaluation of its half life is necessary. A new investigation was made of this property, and the value T = 2.696 ± 0.009 days was obtained in good agreement with previous results. (J.S.R.)

2972

ON THE BETA SPECTRUM AND DISINTEGRATION ENERGY OF Sr^{90} AND Y^{90}. Väinö Hovi. Ann. Acad. Sci. Fennicae Ser. A VI, No. 21, 1-12(1959).

Values for the mean energy, $\bar{E}_\beta$, of the beta particles of the isotopes Sr^{90} and Y^{90} were determined by using different approximations of the shape correction factor and available spectroscopic data. It is shown that in the case of Sr^{90} the theoretical mean energies corresponding to different approximations of the shape correction factor differ so much from each other that by using modern microcalorimetric techniques at low temperatures it would be possible to get an independent verification of the shape factor. This might be important for clearing up the actual form of the interaction in beta-decay. In the case of Y^{90}, because of the small relative differences between the values of $\bar{E}_\beta$, independent calorimetric verification could hardly lead to as significant results. (auth)

2973

ON THE BETA SPECTRUM AND DISINTEGRATION ENERGY OF RaE, Cl^{36}, AND Ni^{63}. Väinö Hovi and Ilkka Laakso. Ann. Acad. Sci. Fennicae Ser. A VI, No. 26, 1-10 (1959).

Values for the mean energy of the beta particles of the isotopes RaE, Cl^{36}, and Ni^{63} were calculated. In the case of RaE the mean energy was determined from the experimental beta spectrum. The value obtained was in good agreement with the earlier calorimetric result. For the isotope Cl^{36} certain mean energies corresponding to the theoretical analysis of Longmire, Wu, and Townes were calculated. These energies exhibited a marked spread. In the case of Ni^{63} the values of the mean energy were calculated for an allowed and for a first forbidden α-shape. Both these shapes have been previously suggested by spectroscopic experiments. By carrying out independent calorimetric measurements at low temperatures it should be possible to distinguish between these two shapes. (auth)

2974

POTENTIAL SCATTERING OF NEUTRONS IN THE RESONANCE REGION. W. Ratyński, J. Turkiewicz, and P. Zuprański (Warsaw Univ. and Polish Academy of Sciences, [Warsaw]). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 527-9(1959).

Transmission measurements for various elements were carried out using a continuous neutron spectrum of a reactor. The plots of ln T vs. sample thickness were obtained for Al, Ag, and Bi for which the calculated

cross sections are 1.4 ± 0.1, 5.3 ± 0.4, and 8.9 ± 0.4, respectively. It seems reasonable to interpret the slopes of these curves for large sample thicknesses as potential-scattering cross sections. (auth)

2975

INTERNAL CONVERSION ELECTRONS OF ^{167}Tu. S. Chojnacki, R. Sosnowski, O. Wołczek, I. A. Yutlandov (Joint Inst. for Nuclear Research, Dubna, USSR) and H. Lancman and J. Zylicz (Inst. for Nuclear Research, Warsaw). Bull. acad. polon. sci., Ser. sci., math., astron. et phys. 7, 535-8(1959).

The K and L + M + N conversion lines were determined for the 207.5-kev transition in thulium-167. The conversion coefficient of the K line of the 534 kev transition was calculated to be $a_k = (2.0 \pm 0.8) \times 10^{-3}$. (C.J.G.)

2976

STABILIZATION OF MAGNETIC FIELD OF AN ELECTROMAGNET. Rudolf Becherer and Richard Reimann (Laboratoire d'Électronique et Radioélectricité de la Sorbonne, Paris). Compt. rend. 249, 1340-2(1959) Oct. 12. (In French)

The magnetic field of an electromagnet fed by a dynamo at 7a continuously was stabilized. The fast fluctuations were suppressed by an LC filter, then by one control stage with a counter-reaction loop. Slow fluctuations which provoke a variation of the magnetic field are detected by proton magnetic resonance and reduced by the same control stage. (T.R.H.)

2977

THE INTERACTION OF NEGATIVE π MESONS AT 300 Mev WITH THE NUCLEI OF NUCLEAR EMULSIONS. Brigitte Chemel. Compt. rend. 249, 1625-7(1959) Oct. 28. (In French)

The mean free path of interaction λ of π^- mesons with the nuclei of nuclear emulsions is of the order of 26.8 ± 1.4 cm. The differential cross section has a minimum toward 75°. (tr-auth)

2978

EFFECTIVE CROSS-SECTION OF Th^{229} FISSION. B. M. Hokhberg, G. A. Otroshchenko, and V. A. Shigin (Inst. of Atomic Energy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 128, 911-12(1959). (In Russian)

The energy dependence of Th^{229} effective fission cross section by 6 to 1200 kev neutrons was studied. The plotted experimental data exhibited a different cross section dependence from the typical course of fission cross sections for nuclei fissioned by thermal neutrons. At 20 to 200 kev the cross section diminishes only 20%, at 600 kev it drops rapidly to a minimum, followed by an ~25% rise in the direction of higher energies. The admixture of Th^{232} prevented measurements at energies higher than 1200 kev. (R.V.J.)

2979

TOTAL CROSS SECTION ON N^{15} AND O^{18} FOR NEUTRONS IN THE Mev ENERGY RANGE. L. Schellenberg, E. Baumgartner, P. Huber, and F. Seiler. Helv. Phys. Acta 32, 357-76(1959). (In German)

The total cross section of O^{18} for neutrons in the energy range from 2.82 to 4.17 Mev and of N^{15} in the energy range from 2.80 to 3.62 Mev was measured by means of a conventional transmission experiment using the d–d reaction as neutron source. For N^{15} a level at 5.26 Mev was found. Possible spin and parity assignments are 3± or less probably 4^+ or 2^-. For O^{18} the cross section shows a complex structure with 4 distinct maxima. Due to overlapping resonances and possible inelastic scattering, an interpretation is difficult. However, by making some simplifying assumptions a reasonable fit to the data was obtained with levels at 8.83, 6.97, 7.26, and 7.73 Mev and the spin and parity assignments $3/2^+$, $1/2^-$, $1/2^-$, and $1/2^-$ respectively. (auth)

2980

GAMMA ANGULAR DISTRIBUTION IN THE ELECTRICAL EXCITATION OF DEFORMED ODD-EVEN NUCLEI. J. de Boer, M. Martin, and P. Marmier (Eidgenossisch Technische Hochschule, Zürich). Helv. Phys. Acta 32, 377-411(1959). (In German)

Yield and angular distribution of the gamma radiation following electric excitation of Eu^{151}, Eu^{153}, Gd^{155}, Gd^{157}, Dy^{163}, Er^{167}, Yb^{173}, Hf^{177}, Hf^{179}, Re^{185}, and Re^{187} were measured using 4 Mev protons. Transition probabilities and mixing ratios as well as moment of inertia, deformation parameter, and nuclear gyromagnetic ratios are deduced from experimental results. (auth)

2981

THE CROSS SECTIONS OF (p,n) REACTIONS FOR THE NUCLEI OF ATOMIC NUMBER 22 TO 30. S. Tanaka (Univ. of Tokyo). J. Atomic Energy Soc. Japan 1, 171-3(1959). (In Japanese)

The measurements of the (p,n) cross sections for titanium through zinc by means of the activation method are summarized. The analysis of the experimental results was made for some typical examples on the basis of the statistical model of nuclear reactions, and the validity of this simple model was discussed. (auth)

2982

THE SPECTRUM OF CONVERSION ELECTRONS EMITTED DURING THE $Pa^{233} \rightarrow U^{233}$ TRANSITION. Georgette Albouy (Laboratoire de Physique Nucléaire, Orsay, France) and Manuel Valadarès (Centre National de la Recherche Scientifique, Orsay, France). J. phys. radium 20, 816-26(1959) Oct. (In French)

The conversion electron spectrum emitted during the $Pa^{233} \rightarrow U^{233}$ transition was studied by magnetic spectrography. New lines were observed, energy values of various γ rays more precisely determined, and their multipolarity deduced. Relative intensities of some of these rays do not agree with the level scheme at present accepted. (auth)

2983

CALORIMETRIC MEASUREMENT OF THE PERIOD OF Y^{90}. J. Robert (Laboratoire Curie, Paris). J. Phys. radium 20, 830-1(1959) Oct. (In French)

An automatically compensated adiabatic microcalorimeter was used to measure the period of Y^{90}. The result obtained T = 64.3 ± 0.4 hr is in good agreement with previous values obtained by other methods. (J.S.R.)

2984

STUDY OF PHOTON RESONANT SCATTERING BY MAGNESIUM. M. Langevin and A. Bussière de Nercy (Laboratoire de Physique Nucleaire, Orsay, France). J. phys. radium 20, 831-3(1959) Oct. (In French)

Gamma resonant scattering by magnesium was studied, and the pulse spectrum obtained with a beam energy of 12.5 Mev has a maximum at 10.3 ± 0.5 Mev. The level excited was determined to be the 10.50 ± 0.14 Mev level with an integrated cross section of 2.44 ± 0.44 Mev mb, and was attributed to Mg^{24}. This level is probably produced by dipolar excitation and has a spin of 1+. (J.S.R.)

2985

APPROXIMATE VALUE OF SOME ELECTRIC QUAD-

RUPOLE MOMENTS OF NUCLEI WITH MASS A > 218. R. Foucher (Laboratoire de Physique Nucleaire, Orsay, France). J. phys. radium 20, 836-7(1959) Oct. (In French)

The Bohr-Mottelson formula was used to estimate the quadrupole moments and half life of the 2+ level in the region A < 218 from the α-γ angular correlations under the supplementary hypotheses that the recoil nucleus is stopped when it emits gamma radiation and that the electric field gradients of the chlorides and nitrates of these elements are identical. The results obtained for Rn^{220}, Rn^{222}, Ra^{224}, Ra^{226}, and U^{234} agree with approximately the values obtained by direct measurement. Therefore, the process was applied to Rn^{218}, Ra^{222}, Th^{226}, Th^{228}, Th^{232}, and U^{236}. The results of the approximation are tabulated. (J.S.R.)

2986

THALLIUM NUCLEAR RESONANCE SPECTRA. PART II. R. Freeman, R. P. H. Gasser, and R. E. Richards (Physical Chemistry Lab., Oxford). Mol. Phys. 2, 301-308(1959) July.

Chemical shifts are recorded for the thallium resonance of Tl^{203} and Tl^{205} in a number of thallium compounds in the solid state and in aqueous solutions. Different chemical shifts are found for Tl^{+}, $TlCl_4^{-}$, and $TlCl_6^{3-}$. Solid Tl_2Cl_3 shows two thallium resonances with intensities in the ratio 3:1, consistent with the formula $Tl_3(TlCl_6)$. Hydrated thallic chloride in the solid state shows three thallium resonances which may be due to the presence of $Tl(H_2O)_x^{3+}$, $TlCl_4^{-}$, and $TlCl_6^{3-}$. The chemical shifts of the thallium resonance in aqueous thallic chloride and bromide solutions in the presence of added halides are consistent with the stepwise formation of complex ions. The second moments of the resonances of the two thallium isotopes in solid compounds shows that there is spin-spin coupling between the thallium isotopes, and a weak coupling in some cases between thallium nuclei and the nuclei of anions. (auth)

2987

TWO CASES OF TRIPLE FISSION OF URANIUM-235. J. Catala, J. Casanova, and V. Domingo (Centre of Photocorpuscular Physics, Valencia). Nature 184, Suppl. No. 14, 1057-8(1959) Oct. 3.

Two cases of U-235 triple fission were found in photographic plates loaded with enriched uranium and irradiated with thermal neutrons. The fragments resulting from one triple fission were determined to have masses of 150 ± 13 amu, 74 ± 13 amu, and 12 ± 2 amu and correspondingly in the second fission, 169 ± 13 amu, 35 ± 13 amu, and 11 ± 2 amu. (C.J.G.)

2988

CROSS SECTION FOR THE ABSORPTION OF QUANTA BY PAIR FORMATION. H. Hübel, P. Rösh, and M. Scheer (Physikalisches Institut der Universität, Würzburg, Ger.). Naturwissenschaften 46, 574-5(1959). (In German)

The absorption coefficients of copper, silver, and lead were determined at electron energies of 13 and 28 Mev with a pair spectrometer with an energy resolution of 2% and coincidence resolution of 2×10^{-9} sec. The pair formation cross section was obtained by subtracting the absorption caused by the Compton effect and photoeffect from the measured total absorption cross section. The values obtained are analyzed as a function of Z^2. The coefficient b was determined to be $1.6 \times 10^{-5} \pm 14\%$, independent of energy. (J.S.R.)

2989

SLOW NEUTRON CAPTURE AND THE (d,p) REACTION. Charles K. Bockelman (Univ. of Copenhagen). Nuclear Phys. 13, 205-23(1959) Oct. (2).

The suggestion of Lane and Wilkinson that the similarity between (d,p) and (n,γ) spectra may be understood in terms of the target as a unique parent state is applied in detail. An examination of all the available data shows six nuclei for which the assumption appears to be satisfied, and four ambiguous situations. Clear disagreement is found for three nuclei. In order to inquire further into the circumstances responsible for the cases of agreement, the cross section for direct neutron capture with the emission of an electric dipole γ-ray is evaluated with the help of the optical model. Comparison with experiment shows that one of the six cases of agreement can be attributed to direct capture. However (d,p) data do not exist in the region where the optical model predicts the largest direct cross sections. These maxima occur at the same A for which the s-wave strength function is greatest. Measured (n,γ) cross sections for E1 transitions are in many cases compatible with the direct process. (auth)

2990

THE MEASUREMENT OF SHORT LIFETIMES BY A REFINEMENT OF THE RECOIL TECHNIQUE. THE LIFETIME OF THE FIRST EXCITED STATE OF Ra^{224}. J. C. Severiens and F. W. Richter (Univ. of Copenhagen). Nuclear Phys. 13, 239-57(1959) Oct. (2).

It is shown that, by using a simple electron microscope lens to magnify the distance a nuclear recoil travels in the excited state, it is feasible to measure the time down to 2.0×10^{-11} sec in strongly converted transitions from states populated in alpha disintegration. The de-exciting conversion electrons are counted only if they are coming from recoils having a velocity selected by using a delayed coincidence technique. Further developments are discussed which may bring the limits down into the 10^{-12} sec range. The method was tested on the first excited state of Ra^{224} populated in the Th^{228} alpha decay. The lifetime found was $(6.0 \pm 1.6) \times 10^{-10}$ sec, in agreement with other reported measurements. (auth)

2991

NUCLEAR INTERACTIONS OF 660 Mev PROTONS AND THE MOMENTUM DISTRIBUTION OF NUCLEONS IN NUCLEI. L. S. Azhgirey, I. K. Vzorov, V. P. Zrelov, M. G. Mescheryakov, B. S. Neganov, R. M. Ryndin, and A. F. Shabudin (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 13, 258-80(1959) Oct. (2).

An investigation is carried out of the angular distributions and, by magnetic analysis, of the energy spectra of secondary charged particles (mainly protons with energies $\gtrsim$ 60 Mev) emitted at angles of 7°, 12.2°, 18°, 24°, and 30° in interactions of 660 Mev protons with nuclei of Be, C, Cu, and U. The cross sections for emission of such secondary charged particles increase with decrease of the angles. In the order of decreasing energy the various spectral regions of all investigated elements correspond to diffraction scattering of protons on nuclei (in the small angle region), single quasi-elastic proton-nucleon collisions, π-mesons production on bound nucleons and nuclear cascade. The experimental energy spectra for single quasi-elastic proton-nuclear scattering are compared with the spectra computed in the impulse approximation under various assumptions regarding the momentum distribution of the nucleons in the nuclei. The Be and C data are consistent with a Gaussian nucleon momentum distribution

falling to 1/e at an energy of approximately 20 Mev. This means that the mean square value of the nucleon momentum in Be and C nuclei corresponds to an energy of ≈ 30 Mev. (auth)

2992

THE SHAPE OF THE NUCLEAR PHOTO-RESONANCE IN DEFORMED NUCLEI. Ben R. Mottelson and Sven Gösta Nilsson (Nordisk Institut for Teoretisk Atomfysik, Copenhagen). Nuclear Phys. 13, 281-91(1959) Oct. (2).

The characteristic features of photonuclear resonance spectra of deformed nuclei are discussed on the basis of some simple estimates in which we employ nucleonic wave functions in the approximate, "asymptotic" form. The likelihood, in different regions of deformed nuclei, of a resolution of the resonance spectrum into two separate peaks is discussed. A convenient operator method for deriving various nuclear matrix elements in the representation based on the "asymptotic" wave functions is given. (auth)

2993

FAST PHOTONEUTRONS FROM TANTALUM AND GOLD. L. B. Aull, G. C. Reinhardt, and W. D. Whitehead (Univ. of Virginia, Charlottesville). Nuclear Phys. 13, 292-9(1959) Oct. (2).

The photonuclear cross sections for the production of neutrons with energies greater than the $Si^{28}(n,p)Al^{28}$ threshold were determined for tantalum and gold from a maximum bremsstrahlung energy of 18 to 65 Mev. The integrated cross section to 65 Mev is about 800 Mev · mb for tantalum and 700 Mev · mb for gold. The fast neutron integrated cross section is compared with total neutron production cross section at several energies and is about 10% at all energies. (auth)

2994

STUDY OF SOME VERY NEUTRON DEFICIENT ISOTOPES OF PROMETHIUM AND SAMARIUM. I. Gratot, M. Le Pape, and J. Olkowskii [(Commissariat à l'Energie Atomique, Paris)] and G. Ranc (Centre d'Études Nucléaires, Saclay, France). Nuclear Phys. 13, 302-9(1959) Oct. (2). (In French)

The isotopes Pm^{141}, Pm^{142}, Sm^{142}, and Sm^{143} were obtained from several reactions. The mass of Pm^{141} was measured with an isotope separator. The masses of Sm^{142} and Sm^{143} were determined by excitation functions (α,xn). The half-lives were re-determined. Gamma spectra yield the ratios of K-electron capture to positron emission. (auth)

2995

RESONANCES FOR PROTON CAPTURE IN MAGNESIUM. S. L. Andersen, T. Holtebekk, O. Lönsjö, and R. Tangen (Univ. of Oslo). Nuclear Phys. 13, 310-16(1959) Oct. (2).

The yield of beta-rays and gamma-rays from magnesium targets of natural isotopic composition was measured in the proton energy range of 490 kev to 1390 kev, with special emphasis on the region 490 kev to 670 kev. Thirteen new resonances are reported. For some resonances the absolute yield of beta-rays per incoming proton is given. Resonance energies and upper limits for the half-widths are given for a number of resonances. (auth)

2996

SPIN-ORBIT SPLITTINGS IN NUCLEI. II. J. Sawicki (Princeton Univ., N. J. and Univ. of Washington, Seattle). Nuclear Phys. 13, 350-9(1959) Nov. (1).

The j-doublet splittings of single-particle nuclear levels are calculated in terms of the effective two-body spin-orbit interaction operator, the reaction matrix. The recent result of Brueckner et. al., is used for the odd-state K_{LS}^{-}-operator corresponding to Gammel-Thaler potentials. On the same basis the even-state K_{LS}^{+} is neglected. The exchange amplitudes of the K_{LS}^{-}-operator are taken into account and also the "higher derivative" terms. The self-consistent nuclear density of the Ca^{40}-nucleus and other forms of this density are used to calculate the doublet splittings of Ca^{41}. Satisfactory results are obtained. The doublet splittings of the nuclei Pb^{209}, Bi^{209}, O^{17}, and He^{5} are discussed. A discussion is presented of the spin-orbit splittings in spheroidally deformed nuclei. (auth)

2997

COLLECTIVE VIBRATIONS OF CLOSED-SHELL NUCLEI. J. M. Araújo (Universidade do Porto, Portugal). Nuclear Phys. 13, 360-81(1959) Nov. (1).

Collective vibrations in atomic nuclei are studied, assuming a time-dependent nuclear well potential. The collective frequencies (and the collective parameters B_λ and C_λ) are obtained by imposing the condition of time-independence on the expectation value of the energy. The calculations are carried through without the use of adiabatic approximation. For some closed-shell nuclei it is found that the lowest vibrational state should not be of the quadrupole type. The life-times of vibrational states are also calculated. The related problem of static deformations of a finite well potential is discussed. Some numerical results for the quadrupole and octupole vibrations in O^{16} and the quadrupole vibration in Si^{28} are given. (auth)

2998

COMPOUND NUCLEUS PROCESSES IN MEDIUM MASS NUCLEI. A. C. Douglas and N. MacDonald (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nuclear Phys. 13, 382-96(1959) Nov. (1).

In applying compound nucleus theory to a reaction involving many states of the compound and final nucleus, one usually assumes that the level density of the final nucleus depends on the spin I as $\rho_I \propto (2I + 1)$. This leads to the predictions that the angular distribution is isotropic and that the cross-section has the product form $\sigma(A + a \rightarrow B + b) = cF_{aA}F_{bB}$. Recent experiments on (n,p) and (n,α) reactions in nuclei of mass $A \leq 65$ show quite strong angular anisotropies, with symmetry about 90°. The consequences of using a more correct form are examined. Anisotropies in the direction found experimentally are predicted. The degree of anisotropy depends sensitively on σ, and the measurement of angular distributions therefore gives a means of determining this important parameter. The deviation of $\sigma(A + a \rightarrow B + b)$ from the product form is quite small. (auth)

2999

$C^{12}(p,2p)B^{11}$ IN THE IMPULSE APPROXIMATION. K. F. Riley (Cambridge, Univ., Eng.). Nuclear Phys. 13, 407-19 (1959) Nov. (1).

The cross section for $C^{12}(p,2p)B^{11}$ is calculated on the basis of the impulse approximation using a W.K.B. method, in which absorption is taken into account. The effects of reflection and refraction are discussed, and the former is treated approximately. The effect of finite energy resolution on the observed angular distribution of the two protons is found. (auth)

3000

$Cl^{35}(d, p)Cl^{36}$ IN THE UNIFIELD MODEL. M. L. Mehta and C. S. Warke (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 13, 451-5(1959) Nov. (1).

The general expression for the angular distribution of protons derived from Sawicki's transition matrix elements is given. The angular distribution of protons in the reaction $Cl^{35}(d,p)Cl^{36}$ is calculated assuming the strong coupling unified model. Calculation of the integral in the stripping formula takes into account the effect of the deformed surface of the nucleus. The value of the deformation obtained from fitting the observed angular distribution is found to agree roughly with those derived from the quadropole and magnetic moments. (auth)

3001

ELASTIC AND INELASTIC SCATTERING OF 11 Mev PROTONS ON Zn-64, Zn-66, AND Zn-68. R. Beurtey, P. Catillon, R. Chaminade, H. Faraggi, A. Papineau, and J. Thirion (Centre d'Études Nucléaires, Saclay, France). Nuclear Phys. 13, 597-406(1959) Nov. (1). (In French)

The elastic and inelastic scattering of 11 Mev protons on Zn-64, Zn-66, and Zn-68 was studied. The curves of elastic scattering are compared with theoretical curves. Inelastic spectra with good resolution are studied and the curves corresponding to the first excited state obtained. (auth)

3002

NEW "WORLD-AVERAGE" THERMAL CROSS SECTIONS. Donald J. Hughes (Brookhaven National Lab., Upton, N. Y.). Nucleonics 17, No. 11, 132-3(1959) Nov.

A fourth "world-consistent set" of thermal-cross section values for U-233, U-235, and Pu-239 is reported. The greatest change on the order of 1%, of the "World-weighted Averages" for 1959 compared to the "world-consistent set" occurred in U-233. The major discrepancies between countries seem confined to Pu-239 The accuracy of the final averages for 1959 compared to the "world-consistent set" was on the order of 2%. The 1959 world averages for U-235 were almost identical with the "world-consistent set." (C.J.G.)

3003

FISSION PARAMETERS FOR U^{235}. George J. Safford and William W. Havens, Jr. (Columbia Univ., New York). Nucleonics 17, No. 11, 134-8; 205-6(1959) Nov.

A re-examination of all measurements of fission parameters of U-235 in the energy region in which instrumental resolution was not a problem was performed. From experiments, references, and theoretical calculations the following best values were obtained: total cross section, $\sigma_t = 694 \pm 1.3$b; scattering cross section, $\sigma_s = 15 \pm 2$b; absorption cross section, $\sigma_a = 679 \pm 3$b; fission cross section, $\sigma_f = 580 \pm 12$b; capture cross section, $\sigma_c = 99 \pm 13$b; average number of neutrons emitted per neutron absorbed in the fuel nuclide, $\eta = 2.07 \pm 0.02$; number of neutrons emitted per fission, $\nu = 2.43 \pm 0.02$; and the capture-to-fission ratio, $\alpha = 0.172 \pm 0.010$. The errors involved in the experimental values are discussed. (C.J.G.)

3004

RE-ARRANGEMENT COLLISION MATRIX. G. Mohan (National Physical Lab., New Delhi, India). Nuovo cimento (10) 13, 1065-73(1959) Sept. 16.

A study of the rearrangement collision matrix under certain asymptotic assumptions is made. It is found that although the asymptotic states are nonorthogonal, by a proper choice an orthogonal and complete set of physical states with prescribed asymptotic properties can be constructed. Identity of different expressions of the collision matrix is re-derived. Finally, by the help of the collision matrix the state vector itself is expressed in a form where the incoming and outgoing waves into various channels are explicitly separated without putting any configuration space restrictions. (auth)

3005

FINAL STATE INTERACTION IN $^5He_\Lambda$ DECAY. R. Ammar, R. Levi Setti, and W. E. Slater (Univ. of Chicago) and S. Limentani, P. E. Schlein, and P. H. Steinberg (Northwestern Univ., Evanston, Ill.). Nuovo cimento (10) 13, 1156-64(1959) Sept. 16.

The distribution of certain kinematic quantities defined in the decay $He^5_\Lambda \rightarrow \pi^- + p + He^4$ are interpreted as being due to the presence of a strong final state interaction. In particular the data are discussed with reference to two simple theories, one of which takes into account the specific p-He^4 nuclear interaction. The experimental evidence, although not conclusive, is consistent with the expectation that the p-He^4 $p_{\frac{3}{2}}$ resonance plays an important role in determining the final state configurations. (auth)

3006

POLARIZATION OF CONVERSION ELECTRONS FOLLOWING BETA DECAY. R. L. Becker and M. E. Rose (Oak Ridge National Lab., Tenn.). Nuovo cimento (10) 13, 1182-1225(1959) Sept. 16.

Because of the breakdown of the symmetry principles in weak interactions, β decay provides a means of producing polarized nuclei. In allowed transitions only first rank polarization, and in forbidden transitions higher odd rank orientation, is produced. This orientation is manifested in the polarization of subsequent radiations. A complete discussion of the polarization of internal conversion electrons from the K shell is given. In allowed transitions there is an appreciable longitudinal and also transverse polarization. The latter is in the plane of the momentum vectors of the β particle and conversion electron. In general these polarizations also appear in forbidden transitions where contributions from higher odd rank orientation are present. In addition, the forbidden transitions are characterized by a component of polarization perpendicular to the β-conversion electron plane. This component, which arises from the even rank orientations (for example, alignment), is a classical effect of the coincidence observation. Unfortunately, this transverse polarization is very small (a few percent at most) under practical conditions. Expressions for the polarization components are given in terms of extensively tabulated angular correlation coefficients and particle parameters for the three types of polarization. Numerical results for the longitudinal and transverse in-the-plane polarization parameters are included for mixed as well as for pure multipole transitions. Particular decay schemes involving allowed and first forbidden unique β transitions are considered in detail and numerical values for these polarizations are given. (auth)

3007

GENERALIZED CURRENT CONSERVATION AND LOW ENERGY LIMIT OF PHOTON INTERACTIONS. E. Kazes (Univ. of Wisconsin, Madison). Nuovo cimento (10) 13, 1226-39(1959) Sept. 16.

If the fields that describe a system are renormalizable their interaction with low-energy photons in the first two orders in the frequency is shown to be given by the static properties of the system. This is shown to essentially follow from current conservation. Compton scattering, bremsstrahlung, and photo-pion production are examined. In the latter case, although the result is gauge invariant in the first two orders in the frequency, one is not certain

of obtaining all terms of this order. The missing terms probably arise from Feynman diagrams in which the photon is connected to a part containing no charged links to the rest. (auth)

3008

ON THE SURFACE EFFECT IN NUCLEAR PHOTOREACTIONS. V. De Sabbata (Università, Ferrara, Italy and Istituto Nazionale di Fisica Nucleare, Bologna) and A. Tomasini (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 13, 1268-72(1959) Sept. 16.

A study is given on the interaction of γ rays with the nucleons at the nuclear surface. Cross section and angular correlation computations are made for O^{16} and for a nucleus with A = 40 (N = Z). (C.J.G.)

3009

ON SURFACE DIRECT PHOTONEUTRONS. A. Agodi, E. Eberle, and L. Sertorio (Università, Catania, Italy and Centro Siciliano di Fisica Nucleare, Catania, Italy). Nuovo cimento (10) 13, 1279-81(1959) Sept. 16.

Experimental results on the energy spectra of photoneutrons from Ca^{40} and Rh^{103} targets, irradiated with bremsstrahlung protons of 30 Mev max energy, show an unusually high yield of photoneutrons at 3.5 and 4 to 7 Mev, respectively. These results were studied in terms of E1 single particle transitions by taking into account off-resonance effects neglected in Wilkinson's theory. Surface effects in energy spectra of photoneutrons from Ca^{40}, Cr^{52}, and Rh^{103} were calculated by assuming j−j coupling for the initial shell model nuclear state and considering transitions from the last filled neutron shell only. The theoretical points fit reasonably well with the experimental results. (C.J.G.)

3010

INTERACTIONS OF 1.15 GeV/c K^- MESONS IN EMULSIONS. PRELIMINARY RESULTS. C. M. Garelli, B. Quassiati, L. Tallone, M. Vigone (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 13, 1294-5(1959) Sept. 16.

In a preliminary scanning of a large stack of G-5 emulsions exposed to a 1.15 Bev/c K^--meson beam a total of 400 interactions was studied. The mean number of prongs per star was determined to be 5.6 ± 0.6 in the stars found by track following and 6.2 ± 0.4 in the stars found by area scanning. The composition of the 400 stars is analyzed. (C.J.G.)

3011

THE USE OF POLARIZED NEUTRONS IN DETERMINING THE MAGNETIC SCATTERING BY IRON AND NICKEL. R. Nathans (Pennsylvania State Univ., University Park and Brookhaven National Lab., Upton, N. Y.); C. G. Shull (Massachusetts Inst. of Tech., Cambridge); G. Shirane (Brookhaven National Lab., Upton, N. Y.); and A. Andresen (Brookhaven National Lab., Upton, N. Y. and Joint Establishment for Nuclear Research, Kjeller, Norway). Phys. and Chem. Solids 10, 138-46(1959) July.

The polarized neutron-beam technique is discussed and utilized in determining the magnetic scattering by iron and nickel. Procedures for obtaining and using polarized beams of monochromatic neutrons are outlined, and experimental data are presented on the performance of two polarizing crystals, Fe_3O_4 and 92 Co-8 Fe alloy The reflectivity of neutrons of different polarization states by single crystals of iron and nickel has been studied and used for determining the magnetic scattering amplitudes at various scattering angles. Comparison is then made between the observed magnetic form values and theoretical values derived from calculated 3d wave functions. (auth)

3012

MESON CORRECTIONS TO THE HYPERFINE STRUCTURE IN HYDROGEN. C. K. Iddings and P. M. Platzman (California Inst. of Tech., Pasadena). Phys. Rev. 115, 919-21(1959) Aug. 15.

It has been shown that the form factor of the proton, measured by Hofstadter, implies an energy shift in the hyperfine structure of atomic hydrogen. Uncertainties in this method of applying the Hofstadter data, due to the effects of virtual mesons, are investigated in an approximate way and found to be small, on the order of one to two percent of the total correction. Under certain assumptions about the form of the amplitudies for various photoproduction processes, it is concluded that the value of the fine-structure constant implied by the hyperfine structure measurement of Kusch disagrees with the value obtained from the Lamb shift by 34 ± 21 ppm. (auth)

3013

(p,n) CROSS SECTION AND PROTON OPTICAL-MODEL PARAMETERS IN THE 4- TO 5.5-Mev ENERGY REGION. Richard D. Albert (Univ. of California, Livermore). Phys. Rev. 115, 925-7(1959) Aug. 15.

(p,n) cross sections were measured for 18 medium-weight nuclei in the 4- to 5.5-Mev region. In this energy region, de-excitation of the compound nucleus by neutron emission is largely favored over charged particle emission; consequently, the (p,n) reaction dominates competing compound-elastic and inelastic scattering processes. The experimental results are compared with theoretical reaction cross sections predicted by the optical model for protons. It is found that the parameters which provide the best theoretical fit to these data also provide reasonable fits to neutron total, nonelastic, and elastic cross sections measured elsewhere when the latter are compared with theoretical cross sections predicted by the optical model for neutrons. It is concluded that the intrinsic nuclear well depth for protons and neutrons are equal to within ±7% uncertainty. (auth)

3014

EXCITATION FUNCTIONS FOR ALPHA-INDUCED REACTIONS ON ZINC-64. Norbert T. Porile (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 115, 939-48 (1959) Aug. 15.

Eleven excitation functions for alpha-induced reactions on Zn^{64} were measured up to incident energies of 41 Mev. The values of $\sigma(\alpha,p)/\sigma(\alpha,n)$ and $\sigma(\alpha,pn)/\sigma(\alpha,2n)$ in the region of maximum yield were found to be 1.7 and 9, respectively. Reactions involving alpha-particle emission account for about 20% of the total inelastic cross section at 40 Mev. The total inelastic cross section was found to agree with calculated values for $r_0 = 1.6 \times 10^{-13}$ cm. The competition between different reactions was analyzed in terms of the statistical theory by use of a level density expression of the form $W(E) = C \exp\{2[a(E-\delta)]^{1/2}\}$. Values of a ranging from 0.8 to 2.8 were required to fit the experimental results, indicating that the statistical theory is not completely applicable. (auth)

3015

RESULTS OF STRIPPING ANALYSIS OF THE REACTION $K^{39}(d,p)K^{40}$. H. A. Enge, E. J. Irwin, Jr., and D. H. Weaner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 115, 949-55(1959) Aug. 15.

The MIT-ONR electrostatic generator and the broad-

range spectrograph were used to study the energies and angular distributions of protons emitted from a KI target bombarded with 6-Mev deuterons. Excitation energies are given for fifty-two levels in K^{40}. Orbital angular momenta of captured neutrons in the stripping process are given for thirty-eight of these excited levels and for the ground state. The reaction energy for the ground-state transition was measured as Q = 5.569 ± 0.010 Mev. (auth)

3016

DIFFERENTIAL CROSS SECTIONS OF SOME (α,p) REACTIONS. C. E. Hunting and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 115, 956-61(1959) Aug. 15.

Using 30.4-Mev alpha particles, proton differential cross sections were obtained for the following transitions, corresponding to discrete states of the residual nuclei: $B^{10}(\alpha,p)C^{13}$ ground-state; $Na^{23}(\alpha,p)Mg^{26}$ ground- and 1.83 Mev-states; $Al^{27}(\alpha,p)Si^{30}$, ground- and 2.24-Mev states; and $P^{31}(\alpha,p)S^{34}$, ground-state. A proton energy spectrum corresponding to the first 12 Mev of excitation of the residual nucleus was obtained for the case involving the Al^{27} target. The differential cross sections are interpreted with the aid of predictions of the Butler direct-interaction (surface) theory. It is concluded that this theory is probably a more useful tool in interpreting the results obtained than is the compound nucleus theory. Some deviations from the predictions of the surface direct-interaction calculations are discussed. (auth)

3017

SCATTERING OF 2- TO 4-MEV POLARIZED NEUTRONS BY CARBON. W. P. Bucher, W. B. Beverly, G. C. Cobb, and F. L. Hereford (Univ. of Virginia, Charlottesville). Phys. Rev. 115, 961-2(1959) Aug. 15.

The right-left asymmetry in elastic scattering of partially polarized neutrons by carbon was observed for 45° (c.m.) scattering angle and for neutrons in the 2- to 4-Mev energy range. The C^{12}(n,n) polarization, inferred from the measured asymmetries, has a direction and energy dependence in agreement with phaseshift analyses obtained previously by others. The magnitude of the polarization is slightly larger than predicted. (auth)

3018

SHELL-MODEL THEORY OF INELASTIC SCATTERING ON Be^9. William T. Pinkston (Princeton Univ., N. J.). Phys. Rev. 115, 963-8(1959) Aug. 15.

A study is made of the energy levels of Be^9 with particular emphasis on comparing the inelastic-scattering data with the shell-model predictions. The differential cross sections for inelastic scattering of alpha particles are calculated in distorted-wave Born approximation using a central spin-independent potential to represent the interaction between the incident alpha and each target nucleon. The target wave functions are taken to be intermediate-coupling shell-model wave function. The agreement between theory and experiment is excellent for values of the intermediate coupling parameter, a/K, which best reproduce the level spectra. The results favor a value a/K = 2.86 over the other popular value, a/K = 1.4. It is suggested that the 1.7- and 11.3-Mev levels do not arise from the $(1p)^5$ configuration. (auth)

3019

RESONANCE DETECTION OF NEUTRON ENERGY GROUPS FROM THE Mn^{55} (p,n) Fe^{55} REACTION. L. L. Lee, Jr. and F. P. Mooring (Argonne National Lab., Lemont, Ill.) Phys. Rev. 115, 969-73(1959) Aug. 15.

The excitation energies of low-lying levels in Fe^{55} and the Q-value of the $Mn^{55}(p,n)Fe^{55}$ reaction were measured by determining the proton energies at which 257-kev neutrons are produced. The ratio of the number of neutrons scattered by a ½-in. thick lithium slab to the number of neutrons transmitted was measured as the energy of a proton beam striking a thin manganese target was varied monotonically. Peaks in the ratio curve, indicating the presence of 257-kev (the energy for resonant neutron scattering from lithium) neutron groups from the reaction, occur at particular proton energies, and Q-values can readily be computed. A ground-state Q-value of (−1.011 ± 0.005) Mev was measured for the $Mn^{55}(p,n)Fe^{55}$ reaction and states in Fe^{55} were located at excitations of 437, 936, 1315, 1414, and 2156 kev. Advantages and limitations of the method are discussed. (auth)

3020

RESONANT ABSORPTION BY THE 9.17-Mev LEVEL IN N^{14}. S. S. Hanna and Luise Meyer-Schützmeister (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 986-9(1959) Aug. 15.

The 9.17-Mev radiation from the reaction $C^{13}(p,\gamma)N^{14}$, E_p = 1.75 Mev, was used to obtain resonant absorption in the inverse process $N^{14} + \gamma \rightarrow N^{14*}$ (E_{ex}= 9.17 Mev). The strength of the absorption was measured as a function of absorber thickness. Analysis of the measurements gives Γ = (77 ± 12) ev and $\omega\Gamma_\gamma$ = (14.5 ± 2) ev. The latter value indicates dipole radiation. (auth)

3021

ABSOLUTE ACTIVATION CROSS SECTIONS FOR REACTIONS OF BISMUTH, COPPER, TITANIUM, AND ALUMINUM WITH 14.8-Mev NEUTRONS. A. Poularikas and R. W. Fink (Univ. of Arkansas, Fayetteville). Phys. Rev. 115, 989-92(1959) Aug. 15.

Absolute neutron activation cross sections at 14.8 Mev were measured for bismuth, copper, titanium, and aluminum based on comparison with the $Cu^{63}(n,2n)Cu^{62}$ reaction (556 millibarns) which served as a standard for monitoring the flux. The reactions studied, measured half lives, and cross sections are: $Bi^{209}(n,\alpha)Tl^{206}$, 4.29 ± 0.05 min, 1.1 ± 0.3 mb; $Bi^{209}(n,p)Pb^{209}$, 3.31 ± 0.03 hours, 0.83 ± 0.40 mb; $Bi^{209}(n,\gamma)Bi^{210}$, ≤1.7 mb; $Cu^{65}(n,2n)Cu^{64}$, 12.85 ± 0.05 hours, 954 ± 130 mb; $Cu^{65}(n,p)Ni^{65}$, 2.56 ± 0.20 hours, 27 ± 11 mb; $Ti^{50}(n,p)Sc^{50}$, 1.8 ± 0.2 min, 27 ± 6 mb; $Ti^{50}(n,p)Sc^{50}$, 22 ± 3 min, 48 ± 15 mb; $Ti^{50}(n,\gamma)Ti^{51}$, ≤9 mb; $Ti^{49}(n,p)Sc^{49}$, 58 ± 2 min, 29 ± 5 mb; $Ti^{48}(n,p)Sc^{48}$, 44.0 ± 0.9 hours, 58 ± 8 mb; $Ti^{47}(n,p)Sc^{47}$, 3.45 ± 0.06 days, 230 ± 40 mb; $Ti^{46}(n,2n)Ti^{45}$, 3.06 ± 0.08 hours, 50.4 ± 8.0 mb; $Ti^{46}(n,p)Sc^{46}$, 85 ± 2 days, ~520 mb; $Al^{27}(n,\alpha)Na^{24}$, 15.00 ± 0.06 hours, 114 ± 7 mb; $Al^{27}(n,p)Mg^{21}$, 9.46 ± 0.02 min, 53 ± 5 mb. Comparisons of the experimental cross sections with values estimated according to the continuum theory of the compound nucleus outlined by Blatt and Weisskopf are in agreement within an order of magnitude, except in the case of the bismuth results which exhibit large discrepancies. From irradiations of natural titanium and highly enriched Ti^{50}, a new activity was observed having a half life of 22 ± 3 minutes. This activity is not produced from enriched Ti^{47} or Ti^{49} samples, and it is therefore assigned tentatively to an isomer of Sc^{50}. Further work on this activity is in progress. (auth)

3022

ANGULAR DISTRIBUTIONS OF PROTON GROUPS FROM THE $Al^{27}(n,p)Mg^{27}$ REACTION AT 14 Mev. O. E. Overseth, Jr. and R. A. Peck, Jr. (Brown Univ., Providence). Phys. Rev. 115, 993-8(1959) Aug. 15.

A study was made of the high-energy proton groups from the $Al^{27}(n,p)Mg^{27}$ reaction at 14 Mev with emulsion detec-

tors, continuous survey being made in the interval 10°–70° (lab system). Proton groups corresponding to the residual Mg^{27} nucleus left in the ground state and at excitations of 1.0, 1.6, 2.1, 2.8, and 3.5 Mev are identified. Several of these groups are characterized by a pronounced peaking in forward directions characteristic of direct interaction processes. The protons leading to the ground-state form a peak in the vicinity of 30°, those to the 1.0-Mev level at 36°, and those to the 1.6-Mev level at about 50°. The 3.5-Mev group is not resolved from known close-lying levels and the cluster exhibits an isotropic distribution. The 2.1-Mev and 2.8-Mev groups, corresponding to no previously reported levels in Mg^{27}, also display an isotropic distribution and probably represent several unresolved levels. The three lowest-lying levels shown approximate fits to theoretical curves consistent with reactions proceeding either by direct collision or by excitation of collective modes. (auth)

3023

ELASTIC SCATTERING OF 14-Mev NEUTRONS BY Al, S, Ti, AND Co. Claude St. Pierre, M. K. Machwe, and Paul Lorrain (Université, Montreal). Phys. Rev. 115, 999-1003 (1959) Aug. 15.

Differential cross sections were measured for the elastic scattering of 14-Mev neutrons by Al, S, Ti, and Co over the angular range from 10 to 138 degrees using a ring geometry and a plastic scintillator as detector. The experimental results are essentially in agreement with the optical model calculations of Bjorklund and Fernbach. (auth)

3024

DECAY OF Pm^{144}. Kenneth S. Toth and O. B. Nielsen (Univ. of Copenhagen). Phys. Rev. 115, 1004-7(1959) Aug. 15.

Pm^{144} was produced by an (α,n) reaction on Pr^{141} in the Copenhagen cyclotron. The half-life of Pm^{144} was determined and found to be closer to 450 days than to the previously reported 300 days. The decay of the nuclide to levels in Nd^{144} was studied, using a 100-channel gamma-ray analyzer and a six-gap β-ray spectrometer. Three γ rays were found, with the following energies: 474, 615, and 695 kev, respectively. It was determined that the three γ rays are E2 transitions and that they are in cascade with one another. A decay scheme for Pm^{144}, consistent with the experimental data, was proposed. (auth)

3025

BACK-ANGLE ELASTIC SCATTERING OF 14.6-Mev NEUTRONS FROM ALUMINUM, COPPER, AND ZIRCONIUM. John D. Anderson, Calvin C. Gardner, John W. McClure, M. P. Nakada, and Calvin Wong (Univ. of California, Livermore). Phys. Rev. 115, 1010-11(1959) Aug. 15.

Differential elastic scattering cross sections were measured for 14.6-Mev neutrons on aluminum, copper, and zirconium in 5° steps from 85 to 155°. The copper and zirconium angular distributions are in good agreement with optical-model calculations by Bjorklund and Fernbach, who employ a spin-orbit coupling term in their potential. The aluminum differential cross sections are systematically higher than the predictions at the back angles, indicating that the Bjorklund-Fernbach optical-model parameters which fit the medium and heavy elements are not as successfully applied to an element as light as aluminum. (auth)

3026

708-kev GAMMA RAY IN P^{30}. J. J. Singh (Univ. of Kansas, Lawrence). Phys. Rev. 115, 1015-16(1959) Aug. 15.

Evidence is presented that the 708-kev gamma ray in P^{30}, arising from a transition between the second excited state and the ground state, is a strongly mixed M1 and E2 transition. It is suggested that the observed E2/M1 amplitude ratio indicates the operation of selection rules for M1 radiation in self-conjugate nuclei. (auth)

3027

SPALLATION OF BISMUTH BY 380-Mev PROTONS. E. T. Hunter and J. M. Miller (Columbia Univ., New York). Phys. Rev. 115, 1053-7(1959) Aug. 15.

Bismuth was bombarded by the 380-Mev proton beam of the Nevis Cyclotron to determine production cross sections of various spallation products. Products isolated and assayed were radioactive isotopes of polonium, bismuth, lead, thallium, mercury, gold, and platinum. Each of these elements was separated from the bismuth targets, carefully purified, and counted using a NaI(Tl) crystal scintillation counter having 4π geometry and $99^{+\frac{1}{2}}_{-4}$% efficiency for photons between 20 and 100 kev. A mass-yield curve was constructed from these results and compared to the mass-yield curve constructed from available Monte Carlo calculations. The calculated data fit the experimental data quite well for products within about 20 mass number units of the target. A lower limit to the total spallation cross section of 1.14 ± 0.05 barns was obtained. (auth)

3028

RADIATIVE CAPTURE OF PROTONS BY Be^9. W. E. Meyerhof (Stanford Univ., Calif.); N. W. Tanner (Carnegie Inst. of Washington, D. C. and California Inst. of Tech., Pasadena); and C. M. Hudson (Office of the Chief of Ordnance, Washington, D. C.). Phys. Rev. 115, 1227-37 (1959) Sept. 1.

The gamma rays from the capture in Be^9 of protons of energy between 0.27 and 1.2 Mev were studied using large scintillation crystals. Excitation functions of the gamma rays leading to the 0-, 0.72-, 1.74-, 2.15-, 3.58-, and 5.16-Mev states of B^{10} were computed from the measured gamma-ray spectra. In addition to the resonances previously known to exist at 0.33-, 0.99-, and 1.086-Mev proton energy [corresponding to (1^-) 6.88-, (2^-) 7.48-, and (0^+) 7.56-Mev states in B^{10}], evidence was found only for the p-wave resonance near 1 Mev [(2^+) 7.5-Mev state in B^{10}] postulated by Mozer and by Dearnaly and for the influence of higher lying states. This work leaves unexplained the large isotopic-spin impurity of the 6.88-Mev level. Appreciable nonresonant capture was found for the transitions to the 0-, 0.72-, 3.58-, and 5.16-Mev states, which is probably not s-wave for the latter two transitions. Accurate energy measurements and coincidence work showed that the 5.16-Mev level of B^{10} is populated in preference to the 5.11-Mev level, contradicting earlier work of Clegg. Also, experimental evidence was found which appears to be in contradiction to the 0^+ spin assignment for the 7.56-Mev level of B^{10} and raises doubts about the 2^+ spin assignment of the 5.16-Mev level. (auth)

3029

INTERACTION OF YTTRIUM WITH PROTONS OF ENERGY BETWEEN 60 AND 240 Mev. Albert A. Caretto, Jr. and Edwin O. Wiig (Univ. of Rochester, N. Y.). Phys. Rev. 115, 1238-42(1959) Sept. 1.

Absolute cross sections are reported for a number of nuclides produced by the interaction with yttrium of protons of 60, 100, 150, 180, and 240 Mev. At low energies the yields can be accounted for by direct interaction or knock-on processes. At higher energies the knock-on cascade model together with evaporation appears to explain the observed yields. (auth)

3030

NUMBER OF PROMPT NEUTRONS EMITTED PER THORIUM-232 FISSION. A. B. Smith, R. G. Nobles, and S. A. Cox (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 1242-3(1959) Sept. 1.

The number of prompt neutrons emitted per Th^{232} fission [$\nu_{Th^{232}}$] is compared to the number emitted per U^{238} fission [$\nu_{U^{238}}$]. At a bombarding neutron energy of 1.4 Mev the ratio $\nu_{Th^{232}}/\nu_{U^{238}} = 0.98 \pm 0.08$. (auth)

3031

MIRROR NUCLEI RADII UTILIZING SELF-ENERGY TERM AND NONUNIFORM CHARGE DISTRIBUTIONS. R. D. Cherry (Univ. of Cape Town, Rondebosch, South Africa). Phys. Rev. 115, 1243-6(1959) Sept. 1.

The nature of the self-energy term in the mirror nucleus energy-difference formula is investigated. Two approaches are used. In the first this self-energy term is assumed to be a constant equal to the Coulomb self-energy of a single proton, and in the second a more refined quantum mechanical approach based on the Swamy and Green Coulomb exchange energy calculations is used. Both approaches yield r_0 values which possess the correct general trend with increasing A, but which disagree with theoretical values for very low A. The effect of nonuniform charge distributions on the values of nuclear radii obtained from mirror nuclei is investigated, and expressions for the Coulomb energy for various charge distributions are given. A direct comparison between the mirror nucleus radii and those obtained from electron scattering is made in the few cases where this is possible. Finally, the possible validity of a suggested value of 0.58 Mev for the Coulomb self-energy of the proton is discussed briefly. (auth)

3032

RADIOCHEMICAL STUDIES OF THE FISSION OF U^{235} INDUCED BY HELIUM IONS. R. Gunnink and J. W. Cobble (Purdue Univ., Lafayette, Ind.). Phys. Rev. 115, 1247-56(1959) Sept. 1.

The absolute fission yields of approximately twenty-five nuclides from the helium-ion-induced fission of U^{235} were determined with an accuracy of ±5 to 15% for several energies ranging from 20 to 40 Mev. Such features of fission as the symmetric-asymmetric modes of fission, the relation of total fission cross section to compound nucleus theory, fine structure in fission product distribution, valley to peak ratios, and neutron emission are discussed as well as some of the experimental detail involved. (auth)

3033

THEORETICAL STUDIES OF THE ALPHA DECAY OF U^{233}. R. R. Chasman and J. O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 115, 1257-63(1959) Sept. 1.

The alpha decay of a deformed odd-mass nucleus, U^{233}, is treated by the use of numerical integration on an IBM-650 computer. The results of this treatement are compared with the theory of Bohr, Fröman, and Mottelson. Approximate analytic methods are developed for predicting the intensities of the higher members of the ground rotational band. A comparison is made between the numerical integration and the experiments of Roberts, Dabbs, and Parker, in which they examine the angular distribution of alpha particles from aligned U^{233} nuclei. The results of the numerical integration of U^{233} are presented in matrices analogous to those of Fröman, and numerical values of the functions are given for selected values of r. (auth)

3034

EXCITATION FUNCTION FOR THE $V^{51}(\gamma,\alpha)Sc^{47}$ REACTION. Palmer Dyal and John P. Hummel (Univ. of Illinois, Urbana). Phys. Rev. 115, 1264-8(1959) Sept. 1.

Yields of the $V^{51}(\gamma,\alpha)Sc^{47}$ reaction were determined by measuring the Sc^{47} radioactivity produced in metallic vanadium targets irradiated with bremsstrahlung of maximum energy varying from 10.5 to 25 Mev. The reaction was not observed below 15.5 Mev because of the severe effect of the Coulomb barrier on the outgoing alpha particles. The excitation function derived from these measurements has a maximum value of 0.81 mb at 23 Mev, and the integrated cross section to 24.5 Mev is 4.3 Mev-mb. The observed excitation function agrees very well with one calculated from a statistical theory for the decay of a compound nucleus. This appears to be a general feature of (γ,α) reactions in medium-weight nuclei. (auth)

3035

NEUTRON FISSION CROSS SECTIONS OF Pu^{236} AND Pu^{237}. J. E. Gindler, J. Gray, Jr., and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 1271-4(1959) Sept. 1.

The thermal-neutron fission cross sections of Pu^{236} and Pu^{237} were determined by counting samples placed in the thermal column of the Argonne heterogeneous heavy-water reactor, CP-5. Comparison of the fission counting rate of the Pu^{236} and Pu^{237} samples with that of a Pu^{239} standard gave cross sections of 170 ± 35 barns, and 2500 ± 500 barns, respectively, for the two nuclides. The K-to-total electron capture branching ratio for Pu^{237} was found to be 0.38 ± 0.06. (auth)

3036

SIMPLE MODEL FOR GIANT RESONANCE EFFECTS IN NUCLEAR REACTIONS. W. Tobocman and D. E. Bilhorn (Rice Inst., Houston, Tex.). Phys. Rev. 115, 1275-7(1959) Sept. 1.

A simple model for the scattering of s-wave neutrons is discussed. The scattering interaction is a square-well potential modified by allowing transmission through the origin to a mode of motion characterized by many narrow resonances. When the coupling out of the incident channel is weak, the cross section is found to have a resonant part which shows the giant resonance behavior observed in nuclear scattering. (auth)

3037

MEASUREMENT OF THE FISSION THRESHOLDS OF Pu^{239}, U^{233}, U^{235}, AND U^{238} USING THE (d,p) REACTION. John A. Northrop, Richard H. Stokes, and Keith Boyer (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 115, 1277-86(1959) Sept. 1.

An experiment is described which measures the fission thresholds of thermally fissionable nuclides. In contrast to fission induced by neutron capture, use of the (d,p) reaction allows compound nuclei to be produced with excitations less than the binding energy of the last neutron. Measurements of the energy spectra of protons in coincidence with fission, normalized by the energy spectra of all emitted protons, allowed the thresholds of Pu^{239}, U^{233}, and U^{235} to be observed. It should be emphasized that the compound nucleus is stable against neutron emission in the region of these fission thresholds, thus avoiding distortion by this competing reaction. The threshold of U^{238} was obtained for comparison with neutron data. In the case of the even-even compound nuclei, the observed step structure of the fission threshold is a clear indication of a multiple fission barrier. This multiple barrier is predicted by the

collective model of fission and is correlated with the experimental data. The equivalent neutron energies at the center of the first threshold are as follows: for Pu^{239}, −1.61 Mev; for U^{233}, −1.47 Mev; and for U^{235}, −0.60 Mev. The second thresholds observable are: for Pu^{239}, −0.72 Mev, and for U^{233}, −0.72 Mev. The threshold of U^{238} agrees well with the data from neutron excitation. In each case the fission probability decreases in the region of positive neutron energies. This would result either if neutron emission were to compete with fission or if there were a significant contribution to the proton spectrum from the electric breakup of the deuteron. (auth)

3038

LOW-ENERGY CAPTURE GAMMA RAYS OF Eu^{152} AND Eu^{154}. Eugene T. Patronis, Jr. and Harvey Marshak (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 115, 1287-9(1959) Sept. 1.

The low-energy capture gamma-ray spectra of Eu^{152} and Eu^{154} were examined up to an energy of 300 kev by the use of a scintillation spectrometer. Eu^{152} was found to exhibit gamma lines at 81 ± 4 kev and 92 ± 3 kev while Eu^{154} exhibited gamma lines at 75 ± 3 kev and 91 ± 3 kev. Coincidence measurements were made on a composite spectrum produced by thermal neutron capture in natural Eu. The data are consistent with the interpretation that the Eu^{154} lines are members of a rotational band while the Eu^{152} lines are not. (auth)

3039

SPONTANEOUS NUCLEAR REACTION IN MOLECULAR HYDROGEN. Richard G. Brewer (Univ. of California, Berkeley). Phys. Rev. 115, 1290-2(1959) Sept. 1.

The probability that two protons in a hydrogen molecule spontaneously react to form a deuteron was calculated by the use of WKB wave functions. The complete shape of the molecular barrier was derived from spectroscopic data for the hydrogen molecule and from a perturbation calculation of the helium atom. Use of this potential function showed that the probability of penetrating the molecular barrier (for a ground-state molecule) is greater by a factor of 10^{15} than of penetrating a Coulomb barrier at the same internuclear distance. The half-lives for nuclear reaction in the isotopic molecules H^1H^1, H^1H^2, and H^2H^2 are 1×10^{57}, 1×10^{47}, and 2×10^{34} years respectively. (auth)

3040

INELASTIC SCATTERING OF 500-Mev ELECTRONS FROM Li^6 AND Li^7. Ulrich Meyer-Berkhout (Stanford Univ., Calif.). Phys. Rev. 115, 1300-03(1959) Sept. 1.

500-Mev electrons were scattered from enriched Li^6 and ordinary Li(92.5% Li^7) between scattering angles of 60° and 135° in the laboratory system. The cross section integrated over the inelastic continuum at these large momentum transfers was compared with the free-proton cross section at the corresponding angles. The results when compared with those obtained for other light nuclei may be used to yield some insight as to the extent to which the scattering from the individual nucleons can be considered as incoherent. (auth)

3041

SEARCH FOR Li^4. S. Bashkin, R. W. Kavanagh, and P. D. Parker (California Inst. of Tech., Pasadena). Phys. Rev. Letters 3, 518-20(1959) Dec. 1.

The $Li^4(\beta^+ \nu)He^4$ reaction was studied by counting the delayed positrons. For a mean life in the range 0.006 to 600 sec the cross section is $\lesssim 4 \times 10^{-11}$ barn which shows that Li^4 is not bound. Implications of the data are strong that Li^4 is not particle-stable and does not have such a state. (C.J.G.)

3042

MEASUREMENT OF THE SPIN AND PARITY OF THE ANOMALOUS INELASTIC STATES IN Ni^{58} AND Ni^{60}. M. Crut and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Letters 3, 520-2(1959) Dec. 1.

Experiments were performed which established the spin and parity of the 4.5-Mev structure in Ni^{58} and Ni^{60} as 3^-. The angular distribution of alpha particles and angular correlation of gamma rays scattered from Ni^{58} and Ni^{60} are shown. Approximately (62 ± 20)% of the time the anomalous structure was excited in Ni^{58} and (50 ± 20%) in Ni^{60} the level or levels involved decayed to the first excited state. (C.J.G.)

3043

THE EFFECTIVE RESONANCE ABSORPTION INTEGRAL OF ^{238}U IN HEAVY-ATOM MIXTURES. Cavid Erginsoy (Middle East Technical Univ., Ankara). Reactor Sci. 10, 1-7(1959) July.

The resonance absorption of neutrons by U^{238} in admixtures containing elements of medium or high atomic weight is considered. The contributions of the eighteen resolved resonances are calculated for three different dilutions corresponding to potential scattering cross sections per U^{238} atom of 10 (pure U^{238} metal), 100, and 1000 barns. A good approximation is obtained to the exact Hurwitz solution for a non-hydrogeneous moderator, from which the effective resonance integrals are calculated. The effect of Doppler broadening at T = 300°K is included. The region of unresolved resonances is taken from 420 ev to 1 Mev and the resonance integrals are evaluated for this region, taking into account levels associated with $l > 0$ neutrons. Important differences are found from the predictions of a simple 'narrow resonance' approximation. (auth)

3044

THE CAPTURE CROSS-SECTION OF ^{197}Au FOR FAST NEUTRONS. A. T. G. Ferguson and E. B. Paul (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 10, 19-21(1959) July.

The fast neutron activation cross sections for Au-197 were measured at 150 ± 15, 550 ± 30, and 1000 ± 30 kev energies, giving values of 270 ± 18, 118 ± 8, and 97 ± 13 mb, respectively. The values depend on absolute β counting and the variation of hydrogen cross section with energy. (auth)

3045

EXCITATION OF ISOTOPIC AND FINE STRUCTURE IN LITHIUM RESONANCE LINE. Chao Kuang-tsêng. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 1, 75-8(1959). (In Russian)

The fine and isotopic structure of the lithium resonance line λ 6708 A was investigated in relation to current and gas motion (argon) in order to find the optimum excitation conditions. (R.V.J.)

3046

ON THE ENERGY DISTRIBUTION OF RECOIL ATOMS IN (n,γ) REACTIONS. I. Zvara. Vestnik Moskov. Univ. Ser. Mat., Mekhan. Astron., Fiz. i Khim. No. 6, 127-38(1959). (In Russian)

A method is developed and formulas are derived for calculating the energy distribution of recoil atoms in nuclear γ emission. The energy distribution was calculated for recoil atoms of the $Cl^{35}(n,\gamma)Cl^{36}$ and $S^{32}(n,\gamma)S^{33}$ reactions. The

absence of chemical bond breakage, due to the low recoil energy was observed only in the case of HCl. (R.V.J.)

3047

RESONANCE ENERGIES FOR PROTON CAPTURE. I. MAGNESIUM. S. Wagner and M. Heitzmann (Physikalisch-Technische Bundesanstalt, Brunswick, Ger.). Z. Naturforsch. 14a, 784-6(1959) Sept. (In German)

Using a stabilized electronic cascade generator, the following resonance energies for proton capture were determined on thick Mg targets of natural isotopic composition: $Mg^{24}(p,\gamma)Al^{25}$ (223.0 ± 0.5 and 419.1 ± 0.7 kev), $Mg^{25}(p,\gamma)Al^{26}$ (316.1 ± 0.5, 389.3 ± 0.7, 434.6 ± 0.8, 496.5 ± 0.8, 514.8 ± 0.8, 567.2 ± 0.7, 591.9 ± 0.7, 685.2 ± 1.0 kev), and for $Mg^{26}(p,\gamma)Al^{27}$ (292.2 ± 0.8, 338.1 ± 0.5, 453.8 ± 0.5, and 662.1 ± 1.0 kev). The energies were determined from measurements with a voltage divider calibrated by the 504.5 ± 0.3 and 506.5 ± 0.3 kev resonances of the $Al^{27}(p,\gamma)Si^{28}$ reaction. The experimental width at half maximum intensity of the resonances studied amounted to 200 to 500 ev. (tr-auth)

3048

LINEAR RELATION BETWEEN NUCLEON REMOVAL ENERGY AND MASS NUMBER. F. Everling (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 787-90 (1959) Sept. (In German)

The nucleon removal energies S_n and S_p are presented as a function of mass number A in the region $17 \leqq A \leqq 29$ for the ground state and lower excited states of mirror nuclei with A = 4n + 1 (n is whole) and spin isobar component $T_\zeta = +\frac{1}{2}$ or $-\frac{1}{2}$. A corresponding diagram is given for the removal energies of neutrons and protons $S_{n,p}$ for odd-odd self mirror nuclei. For S_n and S_p there are 4 values each lying within the limits of a straight line, of which 3 each have equal spin and equal parity $J^\pi = \frac{1}{2}^+$, whereas one value of each, namely Ne^{21*} (1.73 Mev) or Na^{21*} (1.46 Mev), is still clearly in error on spin and parity measurement. For $S_{n,p}$ a straight line can be shown running up to 4 times the tolerance limit for the 3 values have $J^\pi = 1^+$ or $(1)^+$, while from Na^{22} (2.22 Mev) the spin and parity relation also is in error. In this case the straight line approaches the empirical value closer and closer to better than 5 parts per 1000. The rise of the straight line $S_{n,p}$ (A) is found to be almost equal to the middle of the rise for S_n(A) and S_p(A). A presentation of S_n as a function of $\frac{1}{2}$ $A^{\frac{2}{3}}$ instead of A distorts the straight line path. It is presumed from this that the difference curve $S_n - S_p$, the compound energy difference of mirror nuclei in the $J^\pi = \frac{1}{2}^+$ condition, also increases with A instead of $A^{\frac{2}{3}}$. (tr-auth)

3049

THE (γ,p) REACTION IN CsI WITH THE γ RADIATION OF THE Li(p,γ) 441 kev RESONANCE. M. Bormann and H. Neuert (I. Institut f. Experimentalphysik, Hamburg). Z. Naturforsch. 14a, 922-3(1959) Oct. (In German)

The (γ,p) reaction in CsI(Tl) was studied with the 17.6 and 14.8-Mev gamma radiation from Li(p,γ). The proton energy spectrum was obtained, and the cross section for the reaction with the mixed radiation was $1.4 \pm 0.5 \times 10^{-27}$ cm. The spectrum was analyzed to determine if the protons were the result of evaporation processes or direct interaction. The results showed that it is not possible to represent the total spectrum as an evaporation spectrum with a single nuclear temperature. Below 6 Mev the nuclear temperature was calculated to be 0.32 Mev and above 6 Mev it was 1.0 Mev. (J.S.R.)

3050

ABSORPTION OF π^+-MESONS WITH AN ENERGY OF APPROXIMATELY 50 MeV BY CARBON NUCLEI. J. V. Laberriggue-Frolova, M. P. Balandin, and S. Z. Otvinovskiĭ (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 634-8(1959) Sept. (In Russian)

A propane bubble chamber was employed to study stars produced in the absorption of 50 ± 20 Mev π^+ mesons in carbon nuclei. The cross section for production of such stars was found equal to 145 ± 36 mb. The star prong distribution is characterized by an average number of prongs equal to 2.6 ± 0.3. An appreciable anisotropy of the angular distribution of the prongs relative to the direction of motion of the π^+ meson was observed. The main cause of this anisotropy is apparently preabsorption scattering of π^+ mesons on separate nucleons in the nucleus. A distribution of two-prong stars with respect to the angle between the prongs is presented. (auth)

3051

GAMMA TRANSITION MULTIPOLARITIES IN Tm^{169}. V. M. Kel'man, R. Ya. Metskhvarishvili, B. K. Preobrazhenskii, V. A. Romanov, and V. V. Tuchkevich (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 639-42(1959) Sept. (In Russian)

The internal conversion coefficients for γ quanta of 63, 94, 110, 130.5, 177, and 198 kev energy on the L subshells of Tm^{169} are found. From these data the transition multipolarities and, in the case of mixed radiations, the percent of the mixture components are determined. (auth)

3052

EJECTION OF α-PARTICLES FROM NUCLEI BY FAST NUCLEONS. V. I. Ostroumov and R. A. Filov (Leningrad Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 643-50(1959) Sept. (In Russian)

The cross section for ejection of α particles with energies >30 Mev from photographic emulsion nuclei under the bombardment of 100, 140, 200, 360, and 660 Mev protons was studied. Ejection of the particles by cascade nucleons was computed under the assumption that the intranuclear nucleons possess definite momenta. It is found that there is an appreciable probability of formation of α substructures in light nuclei of the C^{12} and O^{16} type as well as in the diffuse region of heavy nuclei. (auth)

3053

PRODUCTION OF COMPOSITE NUCLEI IN THE INTERACTION BETWEEN O^{16}, C^{12} AND C^{13} IONS WITH V AND Nb NUCLEI. A. S. Karamyan and A. A. Pleve. Zhur. Eksptl'. i Teoret. Fiz. 37, 654-62(1959) Sept. (In Russian)

Production of composite nuclei in the reactions $V_{23}^{51} + O_8^{16} \rightarrow Ga_{31}^{67}$ and $Nb_{41}^{93} + C_6^{12,13} \rightarrow Ag^{105,106}$ was investigated. The results are obtained in the form of excitation functions with evaporation of various numbers of nucleons. Comparison of these reactions with reactions induced by light particles and involving composite nuclei close to Ga^{67} and Ag^{105} show that in the case of heavy ions evaporation of a given number of nucleons occurs at a somewhat higher excitation energy. A possible explanation of this fact is that the large angular momentum which the heavy ion introduces into the composite nucleus significantly affects the deexcitation process. Along with production of a composite nucleus with subsequent evaporation of nucleons, reactions were observed in which very energetic particles were emitted (60 Mev per two particles), a fact which is not consistent with the statistical theory. (auth)

3054

POSITRON SPECTRUM OF Eu^{152} AND Eu^{152m}. S. F. Antonova, S. S. Vasilenko, M. G. Kaganskii, and D. L. Kaminskii. Zhur. Eksptl'. i Teoret. Fiz. 37, 667-71(1959) Sept. (In Russian)

A low background β spectrometer was employed to study

the spectrum of positrons created in the decay of Eu^{152} and Eu^{152m}. It is found that β^+ decay of Eu^{152} takes place to the first (2^+) and second (4^+) excited states of Sm^{152}. The end point energies of the partial spectra are 713 kev and 470 kev and their intensities are, respectively, 1.4×10^{-4} and 5×10^{-5} β^+ per decay. Formation of Sm^{152} in the ground and first excited states occurs in the positron decay of the Eu^{152m} isomer. The end point energies of the partial spectra are 890 kev and 770 kev, and intensities are, respectively, 6×10^{-5} and 2×10^{-5} β^+ per decay. The excitation energy of the Eu^{152} isomer is deduced from the difference of the end point energies of the β^+ spectra and is found to be 55 ± 6 kev. Pair conversion coefficients and the multipolarities of a number of γ transitions are derived from the positron internal pair conversion spectra. (auth)

3055

RESONANCE SCATTERING OF γ-QUANTA ON THE Mg^{24} NUCLEUS. I. Sh. Vashakidze, T. I. Kopaleishvili, and G. A. Chilashvili (Inst. of Physics, Academy of Sciences, Georgian, RSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 750-5 (1959) Sept. (In Russian)

Resonance scattering of γ quanta on the Mg^{24} nucleus with excitation of the first two levels of 1.37 and 4.23 Mev energy is investigated. An analysis of the correlational formula permits one to draw some conclusions concerning the nature of excitation of the nucleus. (auth)

3056

CIRCULAR POLARIZATION OF γ QUANTA EMITTED BY A NUCLEUS AFTER μ^- CAPTURE. I. S. Shapiro and L. D. Blokhintsev. Zhur. Eksptl'. i Teoret. Fiz. 37, 760-4(1959) Sept. (In Russian)

Formulas are deduced for the circular polarization of γ quanta emitted by a nucleus after μ^- capture. Hyperfine splitting of the mesic atom levels is taken into account. (auth)

3057

EXCITED ROTATIONAL STATES OF NON-AXIAL NUCLEI IN α PARTICLE SCATTERING. E. A. Romanovskiĭ (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 851-3(1959) Sept. (In Russian)

The probability of excitation for even-even nuclei with spin 2 and positive parity during α particle scattering with energy $E \lesssim E_B$ (where E_B is the height of the Coulomb barrier) is estimated in order to determine the role of competing mechanisms of excitation in direct interaction and Coulomb excitation. (R.V.J.)

3058

$0^+ - 0^+$ TRANSITION IN DECAY $Pr^{140} \rightarrow Ce^{140}$. B. S. Dzhelepov, L. F. Uchevatkin, and S. A. Shestopalova (All-Union Inst. of Metrology). Zhur. Eksptl'. i Teoret. Fiz. 37, 857-9(1959) Sept. (In Russian)

An equilibrated preparation Nd^{140} + Pr^{140} was placed into a triple focusing β spectrometer in order to determine whether the 1902 kev level of Ce^{140} is excited during Pr^{140} decay. It was found that the $Ce^{140}(0^+)$ 1902 kev is excited oftener in Pr^{140} decay than in La^{140} (0.013%). The Ce^{140} 1902 kev level appears in electron capture and in Pr^{140} β^+ decay. Considering the values of f_k, f_l, and f_t for permitted transitions, it was found that $ft = 2 \times 10^6$. Thus, the two β^+ decays from the ground state of Pr^{140} into two Ce^{140} states of 0^+ type differ in time approximately 100 fold, which indicates the difference of the internal structure of the states. (R.V.J.)

3059

SPONTANEOUS FISSION OF Am^{241}. V. L. Mikheev, N. K. Skobelev, V. A. Dryin, and G. N. Flerov. Zhur. Eksptl'. i Teoret. Fiz. 37, 859-61(1959) Sept. (In Russian)

The measurements on Am^{241} were carried out during 160 hours with discrimination threshold of 4v. Pulses were recorded for spontaneous fission of Am^{241}, $T_{\frac{1}{2}} = 2 \times 10^{14}$ years, and the high sensitivity of the method produced a $T_{\frac{1}{2}}$ value ~15 fold higher than that of previous experiments. The obtained value is $\sim 10^5$ higher than could have been expected for even-even nucleus with given parameter Z^2/A. Approximately equivalent delay factor was uncovered for spontaneous fission of Pu^{239}, Bk^{249}, Cf^{249}, and Es^{253} and Es^{254}. (R.V.J.)

3060

ANGULAR ANISOTROPY OF γ QUANTA ACCOMPANYING FISSION. V. M. Strutinskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 37, 861-3(1959) Sept. (In Russian)

An analysis was made of causes inducing angular anisotropy of γ quanta accompanying nuclear fission in relation to the fragment scattering direction. The intensity of γ quanta is at its maximum in the direction of fragment scattering. The anisotropic magnitude is 9 and 5%, respectively, for Pu^{239} and U^{235} fission by thermal neutrons. (R.V.J.)

3061

CROSS SECTIONS OF ELASTIC SCATTERING OF 195-Mev π^+ MESONS BY CARBON AND LITHIUM NUCLEI. V. G. Ivanov, V. T. Osipenkov, N. I. Petrov, and V. A. Rusakov (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 863-6(1959) Sept. (In Russian)

Some 410 events of elastic scattering were observed in carbon nuclei and 243 in lithium nuclei. Total cross sections of inelastic interactions were normalized with geometric cross section of nuclei with $R = 1.4\ A^{\frac{1}{3}} \times 10^{-13}$ cm. Correlations of data on carbon nuclei show that cross sections for positive and negative π meson elastic scattering at 195 and 230 Mev are equal within the limits of experimental error. The angular distribution of elastic scattering on carbon and lithium nuclei is plotted. (R.V.J.)

3062

NUCLEAR MOMENTS OF ODD GADOLINIUM ISOTOPES. N. I. Kaliteevskiĭ, M. P. Chaika, I. Kh. Pacheva, and E. E. Fradkin (Leningrad State Univ.). Zhur. Eksptl'. i Teoret Fiz. 37, 882-4(1959) Sept. (In Russian)

Hyperfine structure of Gd lines at 5015, 5103, and 5251 A were studied with a photoelectric spectrometer equipped with Fabry-Perot interferometer. The studies used separated highly enriched gadolinium isotopes (97.3% Gd^{155} and 91.4% Gd^{157}). The spins, the ratio of magnetic moments, and absolute values of the magnetic moments are given. (R.V.J.)

3063

RESONANCE INTERACTIONS OF π MESONS. V. S. Barashenkov and V. M. Mal'tsev (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 884-6(1959) Sept. (In Russian)

Studies were made of the consequences resulting from the hypothesis of (π^--p) resonance interactions in the case when inelastic (π^--p) interactions at E > 1 Bev produce a large number of π mesons. The inelastic (π^--p) interactions at E = 5 Bev are used in the analysis. It is postulated that the hypothesis of $\pi - \pi$ interaction is not binding and it is possible to use other methods for exploring various events previously explained in published literature by the hypothesis of resonance interaction of π mesons. (R.V.J.)

3064

DETERMINATION OF NUCLEAR DEFORMATION BY THE FINE STRUCTURE OF α DECAY. V. G. Nosov. Zhur. Eksptl'. i Teoret. Fiz. 37, 886-7(1959) Sept. (In Russian)

The previously postulated theory of V. G. Nosov (Doklady Akad. Nauk S.S.S.R. 112, 414(1957) on the determination of the surface deformation of daughter nuclei by the fine structure of α decay was verified by calculations and analysis of quadrupole deformation α_2 for 22 even-even daughter nuclei. (R.V.J.)

3065

SECHENIYE VZAIMODEYSTVIYA NUKLONOV PRI ENERGII 9 Bev. (Interaction Cross Section of 9-Bev Nucleons). V. S. Barashenkov and Nien-ning Huang. Dubna, USSR, Ob''yedinennyy Institut Yadernykh Issledovaniy, 1959. 5p.

The interaction cross sections σ_{in} of C, N, O, Br, and Ag were computed at E = 9 Bev and found to be 240, 260, 290, 900, and 1070 tb, respectively. Data from previous works indicated that the total effective interaction cross section ($\varkappa\varkappa$) at E = 9 Bev is $\varphi \simeq 40$ tb, the theoretical value of the mean path of a proton in photographic emulsion Ilford G-5 at E = 5.7 Bev agrees with the experimental value L = 37.6 cm (computed according to optical models), if the distribution of nucleon density in nuclei is taken from experiments with fast neutron scattering by nuclei, and when the theoretical value for the interaction cross section of an incident nucleon and a nucleon in the nucleus is chosen as $\overline{\sigma} \simeq 32$ tb, which also agrees with the experimental value $\sigma = 31.3 \pm 1.5$ tb at E = 6.15 Bev, similar computations based on optical models show an accuracy within a few percent of $\overline{\sigma} = \sigma$ – where σ is the interaction cross section of free nucleons – if the distribution of neutron density in nuclei is taken from experiments with fast neutron scattering by these nuclei at $E \geq 1$ Bev. The predication of similar conclusions at E = 9 Bev is made. A curve of the computed values of the mean free path L = L (σ) of a 9-Bev proton in photographic emulsion NIKFI-R at $\sigma = \sigma$ is shown. This curve differs by only a few percent from an analogous curve L = L ($\overline{\sigma}$), computed for the case where $\sigma = 30$ tb. The theoretical value [length] of the path equals the experimental value, $L = 37.1 \pm 1.0$ cm, if $\overline{\sigma} = \sigma = 30 \pm 0.5$/tb. A rougher experimental value $L = 34.7 \pm 1.5$ cm, results in a proton-nucleon cross-section value of $\overline{\sigma} = \sigma = 33^{+6}_{-3}$ tb. The values obtained for σ are near the total proton-proton interaction cross section at E = 6.15 Bev. The number of component atoms ($\varkappa .10^{-22}$ per cm^3) in photographic emulsions Ilford G-5 and NIKFI-R was $\varkappa_H = 3.37, 2.93$; $\varkappa_C = 1.36, 1.39$; $\varkappa_N = 0.29, 0.37$; $\varkappa_O = 1.02, 1.02$; and $\varkappa_{Ag} = 1.02, 1.02$ respectively. Results of this investigation together with other data show that the optical method may be successfully used to describe interactions of elementary particles at E = 1 Bev. At $E \gg 1$ Bev, nucleon-nucleus interaction cross sections proved sensitive to the form of diffusivity of the nuclear boundary. In this respect, interactions with a collision parameter of the order of a nuclear radius make a major contribution and offer new possibilities for the experimental study of a diffusion nucleus. (TCO)

Particle Accelerators

3066 AECU-4406

[Stevens Inst. of Tech., Hoboken, N. J.]

MEGATRON ACCELERATOR PROGRESS REPORT. K. C. Rogers, D. Finkelstein, G. Brucker, L. Ferrari, I. Mansfield, and D. Caulfield. [Aug. 1959]. 19p. Contract AT(30-1)-2410. OTS.

The Megatron (mega-gauss betatron) is designed to create a 1000 ampere beam of 150 Mev electrons. A low inductance 10^5 joule capacitor bank is charged to 50 kv, then discharged into the field coil, which surrounds a plasma-filled torus. The charged particles are accelerated to peak energy in 6 μsec. A general description of the machine is given and energetics of induction acceleration, field shaping, plasma injection, capacitor bank and switches, the field coil, collision and radiation losses, and diagnostics are discussed. (W.D.M.)

3067 AECU-4446

Midwestern Universities Research Assn., Madison, Wis.

QUARTERLY REPORT OF THE LABORATORY DIRECTOR FOR THE PERIOD JULY 1, 1959 TO SEPTEMBER 30, 1959. 10p. OTS.

The third quarter of 1959 was occupied with putting the finishing touches on components of the Two-Way Model, adjusting the magnetic field to the required magnitude at all points, and life testing completed components. The present status of the model components is given including the magnet, vacuum tank, equipment for acceleration, and injector. Status of various study groups is discussed. A list of papers published, submitted for publication, and presented at meetings for the period Oct. 1958 to Oct. 1959 is given. (W.D.M.)

3068 AERE-R-3012

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CALCULATION OF DRIFT-TUBE DIMENSIONS IN LINAC INJECTOR FOR THE 7 GeV HARWELL PHOTON SYNCHROTRON. R. Taylor. Sept. 1959. 27p. BIS.

The dimensions of the drift tubes in the linac injector for the 7 Bev Harwell proton synchrotron (NIMROD) have been computed by finding, by an iterative method, that geometry of each unit cell in turn which will cause a reference particle to arrive at the center of each accelerating gap at an r.f. phase of −30°. The Laplacian potential was found by an approximate analytical method and by a relaxation method, the latter being superior. The equations of motion were integrated numerically by a method which uses the potential directly instead of the derived field. (auth)

3069 UCRL-8834

California. Univ., Berkeley. Lawrence Radiation Lab.

BEVATRON OPERATION AND DEVELOPMENT. XX. [Period covered] November, December 1958, January 1959. Walter D. Hartsough. Sept. 1959. 21p. Contract W-7405-eng-48. OTS.

Studies of K^--meson interactions continued, using hydrogen and propane bubble chambers and emulsions. Exposures to emulsions were made in the focused and separated K^--meson beams for seventeen groups from outside the laboratory, and for two internal groups. The propane bubble chamber was used to investigate π^--meson interactions. Four target bombardments were made for the chemistry group. The location, exit angle, and focus of the deflected proton beam were measured. On December 14 the west generator and generator motor were damaged as the result of arcing when the machine was stopped by use of dynamic braking after brush contact trouble was noted on the motor. Bevatron operation was resumed on December 30. (auth)

3070

THE MAXIMUM PERMISSIBLE RADIAL DECREASE OF THE MAGNETIC FIELD IN THE CYCLOTRON. A. Valeria Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz Studii ceretări fiz. 10, 329-43(1959). (In Rumanian)

3071

STABILIZATION OF THE ACCELERATION VOLTAGE IN THE CYCLOTRON. I. Teodorescu and A. Valeriu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 361-6(1959). (In Rumanian)

The stabilization system used for the acceleration voltage of the Rumanian U-120 cyclotron is described. Circuit diagrams of the system are given, and the factors controlling the stability are evaluated. (J.S.R.)

3072

FOCUSING AND BEAM ANALYSIS OF THE COLLEGE OF FRANCE CYCLOTRON. Marcel Vivargent. Ann. phys. 4, 1047-1109(1959) Sept.-Oct. (In French)

The College of France cyclotron and preliminary experiments with it are described. A study of the deuteron beam is described. The α beam at 11.3 ± 0.3 Mev and 0.005 to 0.01 μA was used for Coulomb excitation experiments. Targets of Ta, Au, Pt, and Pb were used. The results with Ta confirm those obtained with low-energy particles and constitute a favorable test for the apparatus and method. Coulomb excitation study of Au^{197} gave the values generally obtained. Results with Pt differed from others, and those with Pb offer no conclusion as to the 810 kev line. However, the origin of the high-energy part of the spectrum of Ta^{181} and Au^{197} was fixed. (T.R.H.)

3073

PARTICLE ACCELERATOR FOR INDUSTRY. Karl-Heinz Peter (Leybold Hochvakuum-Anlagen GmbH, Cologne). Atomwirtschaft 4, 439-43(1959) Oct. (In German)

The economy of industrial irradiation processes with accelerators is materially increased by reduction of the specific costs. Further improvements result from a correct choice of the type of radiation, optimum dosage, and irradiation geometry. In this way technical irradiation processes can become of interest for new applications. (auth)

3074

A TYPE OF RELAXATION OSCILLATIONS IN AN ELECTRON BEAM. V. I. Volosok (Inst. of Physics, Siberian Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 128, 495-8(1959) Sept. 21. (In Russian)

Oscillograms of electron beam oscillations were developed with a cylindrical scheme. Rectangular intensity pulses with $\sim 10^{-7}$ sec front, $> 10^{-3}$ sec duration, and repeating time 1.5 sec were delivered to the cathode. A magnetic field fluctuating from 200 to 2000 gauss was applied parallel to the electron beam. A circular current probe was used for recording current to the walls. (R.V.J.)

3075

PRODUCTION OF A MAGNETIC FIELD BY ACCELERATING ELECTRONS IN AN AIR-COIL BETATRON. G. Hentze. Exptl. Tech. Physik. 7, 145-56(1959). (In German)

Preliminary consideration was given to the wattless power of air-coil betatrons. First, the field of collision electrons was produced with a Helmholtz coil the homogeneous field of which was disturbed by an iron core. The Helmholtz coil offers the advantages of contracting and expanding the rings of accelerated electrons. By means of the large stray field of this coil arrangement, much wattless power is needed for field excitation. On this basis two other coil shapes for the acceleration of electrons were used. Because of the small stray field, the need for wattless power becomes substantially less. Finally, reference is made to further results and applications. (tr-auth)

3076

RADIO-FREQUENCY ASPECTS OF ELECTRO-NUCLEAR ACCELERATORS. A. F. Harvey (Royal Radar Establishment, [Malvern, Worcs, Eng.]). J. Brit. Nuclear Energy Conf. 4, 312-27(1959) Oct.

Various forms of electro-nuclear machines for the acceleration of charged particles are described, emphasis being laid on the radiofrequency aspects of the design and performance. Particle electrodynamics and the original d-c and l.f. accelerators are examined. Linear accelerators in resonant and traveling-wave circuit form are described. Orbital or cyclic machines, with both constant and time-varying magnetic fields, are considered. (auth)

3077

A VAN DE GRAAFF ACCELERATOR TUBE OF VERY LOW RETROGRADE ELECTRON CURRENT. D. R. Chick, S. E. Hunt, W. M. Jones, and D. P. R. Petrie (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). Nuclear Instr. and Methods 5, 205-10 (1959) Oct.

By designing the internal electrodes of a Van de Graaff accelerator tube to trap retrograde electrons a voltage of 3.7 Mv was obtained across a nine foot long tube, with immeasurably small electron currents. The performance of this tube is compared with that of tubes employing other internal electrode designs. (auth)

3078

THE ELECTRON VAN DE GRAAFF IN SEMICONDUCTOR RESEARCH. W. L. Brown (Bell Telephone Labs., Murray Hill, N. J.). Nuclear Instr. and Methods 5, 234-41(1959) Oct.

A 1 Mev electron Van de Graaff accelerator was applied to fundamental semiconductor research. Its versatility as a pulsed source of ionization for studying electrical transients in these materials and under d-c operation for introducing atomic defects into solid lattices was exploited. These two aspects of the accelerator are discussed with examples from experiments in germanium. (auth)

3079

COMPENSATING CIRCUITS FOR THE "SATURN" SYNCHROTRON. G. Neyret and J. Parain (Centre d'Etudes Nucléaires, Saclay, France). Nuclear Instr. and Methods 5, 259-65(1959) Oct. (In French)

The main defects of the magnetic field concern the index value, the position of the magnetic median plane, and the residual ripple. For each of the defects, the methods of correcting are explained as well as their practical realization and some experimental results are given. (auth)

3080

THE USE OF ELECTROSTATIC GENERATORS AS INJECTORS FOR ELECTRON SYNCHROTRONS. David Luckey (Massachusetts Inst. of Tech., Cambridge). Nuclear Instr. and Methods 5, 266-8(1959) Oct.

Some experiences with the use of electrostatic generators as injectors for electron synchrotrons at Cornell University and M. I. T. are described. At M. I. T. the injection energy was changed without any other essential modifications to the synchrotron. A factor of ten in intensity was obtained, along with greater stability. Space charge does not appear to be the limiting mechanism of the beam current. (auth)

3081

THE WORLD-BIGGEST ACCELERATOR OF PARTICLES—SYNCHROPHASOTRON. A. A. Kolomenskii and M. S. Rabinowich. Priroda 48, No. 8, 57-61(1959) Aug. (In Russian)

The design, performance, and history of the 10 Bev synchrophasotron constructed in Dubna, USSR, is described. (R.V.J.)

3082

ON THE CAPTURE MECHANISM IN BETATRONS. I. M. Samoĭlov. Zhur. Eksptl'. i Teoret. Fiz. 37, 705-12(1959) Sept. (In Russian)

The motion of electrons in a betatron is considered with account of coulomb repulsion of particles in the beam injected in the chamber during a revolution of the electrons. It is shown that effective electron capture is due to variation of the conditions of the radial oscillations caused by repulsion of the particles in the beam and also to loss of part of the electrons as a result of collision of the beam with the injector or chamber wall. (auth)

3083

SHAPE OF THE MAGNETIC FIELD BETWEEN CONICAL POLE FACES. A. J. H. Boerboom and H. A. Tasman (Laboratorium voor Massaspectrografie, Amsterdam) and H. Wachsmuth (Technische Hochschule, Munich). Z. Naturforsch. 14a, 816-18(1959) Sept.

Calculation is made of the shape of the magnetic field between conical pole faces, which may be used as an inhomogeneous deflecting field for a mass spectrometer. The results are expressed as a series expansion in the coordinates around the main path, and in the gap width at the radius of the main path. (auth)

3084

CALCULATION OF THE ION OPTICAL PROPERTIES OF INHOMOGENEOUS MAGNETIC SECTOR FIELDS, PART 2: THE SECOND ORDER ABERRATIONS OUTSIDE THE MEDIAN PLANE. H. Wachsmuth (Technische Hochschule, Munich). Z. Naturforsch. 14a, 818-22(1959) Sept.

The second order aberrations outside the median plane referring to focusing in the radial direction are calculated. Again the influence of fringing fields is being neglected, and the field boundaries are supposed to be plane and normal to the main path at the point where it enters and leaves the field. (auth)

3085

CALCULATION OF THE ION OPTICAL PROPERTIES OF INHOMOGENEOUS MAGNETIC SECTOR FIELDS, PART 3: OBLIQUE INCIDENCE AND EXIT AT CURVED BOUNDARIES. H. A. Tasman and A. J. H. Boerboom (F.O.M.-Laboratorium voor Massaspectrografie, Amsterdam) and H. Wachsmuth (Technische Hochschule, Munich). Z. Naturforsch. 14a, 822-7(1959) Sept.

Previous calculations are extended to include the effect of oblique incidence and exit at curved boundaries. The influence of the fringing fields on axial focusing when the boundaries are oblique, is accounted for. It is shown that the second order angular aberration may be eliminated by appropriate curvature of the boundaries. (auth)

3086

INVESTIGATION OF ELECTRON CAPTURE IN BETATRON WITH INVARIABLE FIELD IN MAGNET CLEARANCE. D. P. Ivanov, A. P. Komar, and Yu. S. Korobockho (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 975-7(1959) Aug. (In Russian)

Experiments revealed electron capture in the magnetic clearance with constant (time) magnetic field. The captured electrons were detected 900 μsec following the capture, corresponding to about 100 km track length. Observations indicated no appreciable losses in the number of captured electrons along the track. It is postulated that the increase of magnetic field at the clearance does not play a decisive part in the electron capture process. The ratio of captured magnitude to chamber charge injection during one injection cycle is about 2×10^{-4}. (R.V.J.)

3087

A METHOD OF MEASUREMENT OF SUMMARY CHARGE OF ACCELERATED ELECTRONS IN BETATRON. D. P. Ivanov, A. P. Komar, and Yu. S. Korobochko (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 978-80 (1959) Aug. (In Russian)

An attempt was made to measure the charge of accelerated electrons in the betatron with maximum gamma emission of 15 Mev. The cross section of the vacuum chamber and the measuring method are described. The results determined only the lower range of the accelerated electron charge magnitude. The magnitude of the charge was 1.6×10^{-10} coulombs, corresponding to an orbital current of 60 ma. The γ ray intensity at 15 Mev was 4r/min at 1 m from the 1 mm thick tungsten plate target. The low maximum accelerated electron energy and the thickness of the chamber walls (6 to 8 mm porcelain) interfered with the accurate determination of charge. However, it appears possible to measure the charge with high energy electrons. (R.V.J.)

3088

ON THE ROTARY FOCUSING SYSTEM FOR LEAD IN PARTICLES IN SYNCHROPHASOTRON. A. A. Kolomenskiĭ, A. B. Kuznetsov, and N. B. Rubin. Zhur. Tekh. Fiz. 29, 981-91(1959) Aug. (In Russian)

A special rotary-focusing system is suggested for injecting particles and for other purposes. Calculations are given for an injection system for a 10-Bev proton synchrotron. (tr-auth)

3089

PROPER FUNCTIONS OF BETATRON OSCILLATIONS IN CIRCULAR PHASOTRON. Zh. Loshak (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Tekh. Fiz. 29, 995-1008(1959) Aug. (In Russian)

Betatron oscillation eigenfunctions are studied on a simplified accelerator model with a variable radial field. Their analytical expressions and fundamental properties are derived and applied in studies of resonance lines and effects of magnetic field distortions. (tr-auth)

3090

ON THE CALCULATION OF STRONG-FOCUSING ACCELERATOR WITH INVARIABLE MAGNETIC FIELD. V. K. Grishin. Zhur. Tekh. Fiz. 29, 1065-7(1959) Sept. (In Russian)

The parameters of a strongly focusing accelerator with a constant magnetic field (equilibrium orbit, betatron oscillations, magnetic field utilization factor) were calculated. (R.V.J.)

3091

ON THE ACTION OF BETATRON WITH INJECTION OF ELECTRONS BY SHORT PULSES. O. S. Kolotov, Yu. N. Lobanov, and N. I. Tulinova. Zhur. Tekh. Fiz. 29, 1173-4(1959) Sept. (In Russian)

The performance of an experimental betatron with electron injection by short pulses, faster than a single revolution of an electron along the orbit (rectangular 0.01 to 0.5 μ sec pulses with the amplitude of 0 to 2 kw) is described. The increase of electron concentration in the chamber with constant injector current density leads to a proportional increase in radiation intensity. The curves of the above dependence are plotted for various injection currents. (R.V.J.)

Plasma Physics and Thermonuclear Processes

3092 AERE-Bib-124

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

UNITED KINGDOM ATOMIC ENERGY AUTHORITY AND ASSOCIATED BRITISH WORK ON CONTROLLED THERMONUCLEAR REACTIONS. A LIST OF UNCLASSIFIED DOCUMENTS AND PUBLISHED ARTICLES. C. S. Sabel. Aug 1959. 31p. BIS.

References on controlled thermonuclear reactions from book and journal articles and memoranda and reports are presented. This list is essentially a revision of AERE-Inf/Bib-117 in which obsolete reports and memoranda were omitted. The availability of UKAEA unclassified reports is shown. (W.D.M.)

3093 AERE-L-106

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

LECTURES ON THE HYDROMAGNETIC STABILITY OF A CYLINDRICAL PLASMA. V. OBVIOUSLY STABLE DISCHARGE CONFIGURATIONS. R. J. Tayler. Sept. 1959. 19p. BIS.

A plasma configuration is stable against a given perturbation if the change in potential energy due to the perturbation is positive. This change in potential energy is expressed as an integral through the volume of the plasma. The system is obviously stable if the integrand is positive everywhere so that the change in energy is positive in every volume element. Laing has shown that there do exist obviously stable configurations; his work is described and some numerical examples are given. The chief characteristic of all these obviously stable configurations is that the total axial current carried by the plasma is zero. (auth)

3094 AERE-R-2980

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ATOMIC COLLISION PROCESSES IN LOW DENSITY PLASMA. R. W. P. McWhirter. July 1959. 46p. BIS.

Using classical cross sections and assuming a Maxwellian electron velocity distribution, the essential features of the mechanism of ionization of an impure hydrogen plasma of density about 10^{14} particles per cc and electron temperature above 10^6 °K are worked out. It is shown that the time taken for the concentrations of impurity ions to reach a steady state may be longer than the duration of the discharge in Zeta. There is a discussion of the mechanism of excitation of spectral lines. A calculation of the energy radiated by iron impurities in a plasma at temperatures between 10^7 and 10^8 °K is presented. (auth)

3095 NP-8065

[Akademiia Nauk S.S.S.R. Institut Fiziki im. P. N. Lebedeva].

ON THE STABILITY AND FOCUSING OF PLASMA BUNCHES ACCELERATED BY RADIATION. M. L. Levin, M. S. Rabinovich, and G. A. Askar'yan (Askarjan). 31p. [1958?].

The stability and focusing of spherical or ellipsoidal bunches of plasma are studied relative to external steady magnetic fields, ellipsoidal deformations, disturbances of higher harmonics, and wave guides. The relation of density and size of the plasma bunch to penetration of high-frequency fields is discussed. Axial focusing and wave guide focusing are evaluated and acceleration of thin rings whose size is large, when compared with wavelength, is considered. (C.J.G.)

3096 ORNL-2826

Oak Ridge National Lab., Tenn.

DIFFUSION OF PLASMA PARTICLES ACROSS A MAGNETIC FIELD. Akira Isihara and Albert Simon. Nov. 27, 1959. 10p. Contract W-7405-eng-26. OTS.

A previous calculation of the rate of diffusion of like charged particles across a magnetic field is generalized. No "a priori" assumption as to the relative magnitude of certain terms need be made and spatial density gradients are permitted in both directions perpendicular to the field. The final result agrees with that given earlier. (auth)

3097 SRS(PPL)-105

Republic Aviation Corp., Plasma Propulsion Lab., Farmingdale, N. Y.

OPTIMUM POWER GENERATION FROM A MOVING PLASMA. Joseph L. Neuringer. Apr. 1959. 25p. Contract AF49(638)-552. (AFOSR-TN-59-515; AD-216280).

A possible method of electric power generation with thermonuclear fusion which does not involve moving parts is generation by electromagnetic induction using the highly conducting plasma of the reaction products as the working fluid. The inductive action is described. The following question is considered: For a channel of given entrance cross section and length, what must be the shape of the channel, distribution of applied magnetic field strength, and magnitude of applied external loading so that maximum power may be extracted by the external load? (W.D.M.)

3098 SRS-(PPL)-114

Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.

OPTIMUM POWER GENERATION USING A PLASMA AS THE WORKING FLUID. J. L. Neuringer. May 1959. 52p. Contract AF49(638)-552. (AFOSR-TN-59-571; AD-217005).

With the possibility of controlled thermonuclear fusion in the future, the question arises whether it would be possible to use the plasma itself as the working fluid to generate electric power by electro-magnetic induction. The problem considered is the steady one-dimensional motion of a plasma in a channel of arbitrary and slowly varying cross section. The plasma flows across a transverse magnetic field of arbitrarily varying strength, and the conducting channel walls are connected to an external resistive load of arbitrary magnitude. It is asked, "For a channel of given entrance cross section and length, what must be the shape of the channel, distribution of magnetic field strength and external loading so that maximum power may be extracted by the external load?" The extremum problem is formulated using the techniques of the calculus of variations to obtain the appropriate system of differential equations and boundary conditions. For the special cases where the differential constraints, i.e., the fluid flow equations, are integrable, analytical solutions are obtained exhibiting the dependence of the required loading on the Magnetic Reynolds number and the flow Mach numbers based on the sonic and Alfven wave speeds. The power, electrical conversion efficiency, terminal voltage, and distribution of the fluid mechanical variables along the channel are also presented as functions of the above dimensionless parameters. (auth)

3099 UCRL-5046

California. Univ., Livermore. Radiation Lab.

PYROTRON HIGH-ENERGY EXPERIMENTS. C. C. Damm

and F. S. Eby. Apr. 11, 1958. 5p. Contract W-7405-eng-48. OTS.

Approximate single-particle calculations based on simple adiabatic theory and neglecting space-charge fields, indicate that ions can be injected into a time-rising magnetic-mirror field in such a way as to follow trajectories that remain within the containment volume. The possibility of trapping large numbers of ions in this way was investigated experimentally. The measurements were carried out in a bakable stainless steel vacuum tank 45 cm in diameter, 270 cm long. (W.D.M.)

3100 UCRL-8877

California. Univ., Berkeley. Lawrence Radiation Lab. A THEORY ON A HOMOPOLAR DEVICE. C. C. Chang and T. S. Lundgren. Sept. 3, 1959. 21p. Contract W-7405-eng-48. OTS.

This device is analyzed as an incompressible viscous fluid. Over-all properties such as resistance, capacitance, and charging time are calculated, and an equivalent circuit is given. One unexpected result is that for a large applied magnetic field, viscous dissipation and joule dissipation contribute equally to the total rate of dissipation. (auth)

3101 SCL-T-283

PRODUCTION AND STUDY OF HIGH-INTENSITY DISCHARGES. (Production ẽt Etude de Dẽcharges à Forte Intensitẽ). C. Breton, J. Charon, P. Hubert, G. Vendryes, and P. Yvon. Translated by Marcel I. Weinreich (Sandia Corp.) from report CEA-728. 33p. JCL or LC.

Presented at Third International Conference on the Phenomenon of Ionization in Gas, held June 11-15, 1957.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 11537.

3102

CONTRIBUTION TO THE THEORY OF HIGH-FREQUENCY ARC DISCHARGES. Radu Grigorovici and George Cristescu (C. I. Parhon Univ., Bucharest). Acad. rẽp. populaire Roumaine, Rev. phys. 4, 153-76(1959). (In Rumanian)

A study was made which included thermal conductivity of air, energy balance of the arc, calculation of temperature along the axis of the discharge, radial temperature distribution, calculation of the current production characteristic, anisothermality of plasmas of Hf-arc discharges, and Hf arc discharges in different gases. This work puts the problem on a quantitative basis for the first time; the results of the calculations agree with experiment. (T.R.H.)

3103

KINETICS OF IONS IN GASES. Iovitzu Popescu (C. I. Parhon Univ., Bucharest). Acad. rẽp. populaire Roumaine, Rev. phys. 4, 199-209(1959).

Ion motion in conditions similar to those in a glow discharge tube was studied. A retarding field potential was applied to the collector in such a way that ions move in a constant field, or with a breakdown in which case they move in the cathode field of a glow discharge. Both of these cases are analyzed. In part two a picture of positive ion kinetics in foreign gases for E/p high enough to assure an anisotropic movement in the field direction is obtained. (T.R.H.)

3104

THE USE OF MAGNETIC PROBES IN PLASMA DIAGNOSTICS. R. H. Lovberg (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N. Y.) 8, 311-24(1959) Nov.

The technique of magnetic probing of magnetohydrodynamic systems is examined in relation to other diagnostic means. Procedures for extracting plasma data from magnetic field plots are outlined, together with specific examples. Limitations of this type of measurement, particularly for very hot plasmas, are discussed. (auth)

3105

TABULATION OF PRESENT RESEARCH PLANTS FOR NUCLEAR FUSION. M. von Ardenne and W. Feitscher (Forschungsinstitut M. von Ardenne, Dresden). Atompraxis 5, 344-55(1959). (In German)

The attempt is made to give a tabulated survey on plants and problems in nuclear fusion research. The plants were classified according to their data. Each subject heading is supplemented with relevant literature. (auth)

3106

VARIATIONAL METHOD FOR PROPAGATION OF ELECTROMAGNETIC WAVES IN A PLASMA. Leandro Gabarre and Lorenzo Cairó (Institut Henri Poincaré, Paris). Compt. rend. 249, 1750-2(1959) Nov. 2. (In French)

In using the variational principle a first approximation was obtained for the propagation constant corresponding to the TE_{10} mode in a rectangular waveguide containing a thin layer of gyroelectric plasma. (tr-auth)

3107

STUDIES OF DEUTERIUM PLASMA IN HEAVY CURRENT LINEAR PULSE DISCHARGES. K. Nishiguchi, H. Maruo, Y. Arata, and M. Okada (Osaka Univ.). J. Atomic Energy Soc. Japan 1, 115-22(1959). (In Japanese)

The photographic behavior and electric characteristics of deuterium plasma in heavy current linear pulse discharges are described. The behavior is clarified by means of high speed and ordinary cameras. The electric characteristics are obtained by measuring the discharge current and terminal voltage between the electrodes of discharge tube. According to the photographic research by a high speed camera, the plasma core is continuously kept at tube axis for a while after the first pinch occurred, and its shape does not change so much with discharge current. The diameter of the plasma core is almost equal to the plasma shape of the photograph taken by an ordinary camera. It was found that the plasma column is maintained with a considerable stability, even though the distributed return circuit on the circumference of the tube is reduced by about ¼. In case of deuterium plasma, the length of time from the start of discharge to the first pinch coincides fairly well with the calculated value obtained from Leontovich's equation. (auth)

3108

EQUATION OF STATE AND THERMODYNAMIC PROPERTIES OF GASES AT HIGH TEMPERATURES. I. DIATOMIC MOLECULES. O. Sinanoğlu and K. S. Pitzer (Univ. of California, Berkeley). J. Chem. Phys. 31, 960-7(1959) Oct.

Methods for evaluating the thermodynamic properties of assemblies of chemically reacting unionized atoms are discussed. The desirability of using the virial coefficients at high temperatures instead of the customary use of the molecular partition functions with anharmonicity corrections is emphasized. The most realistic three-parameter diatomic potential energy function that is available, the Rydberg potential, $U/U_e = -(1 + b'\xi)\exp(-b'\xi)$ with $\xi = (r/r_e) - 1$ is selected for the evaluation of the classical second virial coefficient. B(T), T(dB/dT), and $T^2(d^2B/dT^2)$ are obtained as linear combinations. A simple expression for estimating the quantum correction to B(T) is given.

The inclusion of the contribution of the higher diatomic electronic states to B(T) is considered. The treatment is applied to sodium (including the $^1\Sigma$ repulsive state), and B(T) and thermodynamic properties calculated at two temperatures by several methods are compared. (auth)

3109

STATISTICAL MECHANICS OF AN INHOMOGENEOUS AND ANISTROPIC LORENTZ PLASMA: STUDY OF THE ELECTRON DISTRIBUTION. Raymond Jancel and Théo Kahan (Institut Henri-Poincaré, Paris). J. phys. radium 20, 804-11(1959) Oct. (In French)

From the results obtained in the first paper (NSA 13: 10553) the system of equations allowing calculation of the terms of zero order and order one of the expansion of the distribution function is given explicitly. For an external oscillating electric field, a stationary solution is obtained by a Fourier analysis superimposed upon the expansion in spherical harmonics. The earlier results are generalized to this case. Physical problems which were treated by these methods are indicated. (auth)

3110

MEASUREMENT OF THE REFRACTIVE INDEX OF A PLASMA IN THE OPTICAL REGION. U. Ascoli-Bartoli and F. Rasetti (Comitato Nazionale per le Ricerche Nucleari, Milan). Nuovo cimento (10) 13, 1296-9(1959) Sept. 16.

The possibility of measuring the electron density in a plasma by observing a decrease in refractive index when the gas is electrically excited was studied. The effects observed on an argon plasma when excited by a radio-frequency field are described. (C.J.G.)

3111

NONRESONANCE ABSORPTION OF ELECTROMAGNETIC WAVES IN A MAGNETOACTIVE PLASMA. B. N. Gershman (Radiophysics Inst., Gorki State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 695-704(1959) Sept. (In Russian)

Absorption (attenuation) of all three types of high frequency waves outside the gyroresonance regions is determined from the general equation. Collisions as well as the absorption mechanism specific for a plasma are taken into account. (auth)

3112

RELATIVISTIC KINETIC EQUATIONS FOR A PLASMA. [PART] I. Yu. L. Klimontovich (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 735-44(1959) Sept. (In Russian)

The relation between the definitions of state probability and distribution functions presented in the papers of various authors is established for the particular case of the kinetic equation for a charged particle in an external electromagnetic field. A random function is introduced which defines the number of particles in an element of phase space. The electromagnetic field strength or number of oscillators are also considered as random functions. The equation set for these functions can be used as a basis for deduction of the equation chain relating the moments of the random functions or the corresponding distribution functions of various orders. A set of relativistic self-consistent equations were derived by approximating this equation chain. Relativistic expressions for dispersion equations of transverse and longitudinal plasma waves are presented. (auth)

3113

SIMPLE WAVES IN THE CHEW, GOLDBERGER AND LOW APPROXIMATION. I. A. Akhiezer, R. V. Polovin, and N. L. Tsintsadze (Inst. of Physics and Tech., Academy of Sciences, Ukrainian RSR and Inst. of Physics, Academy of Sciences, Georgian RSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 756-9(1959) Sept. (In Russian)

Simple waves in a plasma with anisotropic pressure are considered in the Chew, Goldberger, and Low approximation. It is shown that three types of waves exist: Alfven, fast, and slow magnetoacoustic waves. The direction of variation of the magnetodynamical quantities in these waves is investigated. (auth)

3114

NONLINEAR LANGMUIR OSCILLATIONS OF ELECTRONS IN A PLASMA. M. V. Konyukov (Tula Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 799-801(1959) Sept. (In Russian)

An exact solution was obtained for the problem of oscillation of the electron density in a plasma with zero electron temperature. The restrictions on the initial conditions necessary for existence of the oscillations are established. (auth)

3115

ELECTROMAGNETIC PRESSURE ON A CHARGE MOVING IN MAGNETIC FIELD. Ya. B. Fainberg and V. I. Kurilko (Inst. of Physics and Chemistry, Academy of Sciences, Ukrainian SSR). Zhur. Tekh. Fiz. 29, 939-45(1959) Aug. (In Russian)

Electromagnetic pressure on a charge in a magnetic field is analyzed in non-linear approximation. (R.V.J.)

3116

DOPPLER EFFECT IN ELECTRONIC PLASMA WITH MAGNETIC FIELD. K. A. Barsukov and A. A. Kolomenskii (Lebedev Inst. of Physics, Moscow). Zhur. Tekh. Fiz. 29, 954-7(1959) Aug. (In Russian)

A complex Doppler effect produced by oscillating motion in plasma with superimposed magnetic field is studied. (R.V.J.)

3117

ON THE MOVEMENT OF POSITIVE IONS IN PROPER GAS UNDER ACTION OF ELECTRIC AND MAGNETIC FIELDS. Yu. V. Vandakurov and V. I. Perel (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 958-61 (1959) Aug. (In Russian)

The velocity distribution function was derived for gaseous ions in electric and magnetic fields when the mean ion energy exceeds the mean energy of neutral atoms. It is assumed that resonance recharge is the basic process in ion interactions with atoms. (R.V.J.)

3118

ON THE STABILITY OF CYLINDRICAL PLASMA-CONDUCTOR WITH VOLUME CURRENTS. Yu. V. Vandakurov and K. A. Lurie. Zhur. Tekh. Fiz. 29, 1170-3(1959) Sept. (In Russian)

Various possible internal distributions of longitudinal fields are analyzed within the limits of magneto hydrodynamics and incompressible liquid conditions in order to determine stabilized configurations for various currents across the pinch. (R.V.J.)

Shielding Calculations

3119 APEX-503

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

AN IBM 704 PROGRAM REPORT, AIRCRAFT NUCLEAR PROPULSION SHIELDING PROGRAM 10-0. J. W. Haffner, J. J. Loechler, and J. E. MacDonald. Mar. 1958. 36p. Contracts AF33(600)-38062 and AT(11-1)-171. OTS.

Shielding Program 10-0 calculates the fast neutron dose rate at a shielded point detector due to both direct-beam and single-scattered radiation in a homogeneous, infinite medium from an anisotropic point source. The detector shield and the angular distribution associated with the point source are both assumed to be symmetric about the source-detector axis. The fast-neutron-source energy spectrum may be approximated by ten discrete energies. Exponential attenuation may be considered on either leg, as desired. The dose rate arising from the source spectrum is obtained by summation of the dose rates computed for each initial energy and for the rear, side, and front of the detector shield. (auth)

3120

THERMAL PROPERTIES AND HEATING AND COOLING DURABILITY OF REACTOR SHIELDING CONCRETE. J. Hosoi, K. Chūjō, K. Saji, and E. Homma (Nihon Cement Co., Ltd., Research Lab.). J. Atomic Energy Soc. Japan 1, 308-18(1959). (In Japanese)

A study was made of the thermal properties of various concretes made of domestic raw materials for radiation shields of a power reactor and of a high-flux research reactor. The results of measurements of thermal expansion coefficient, specific heat, thermal diffusivity, thermal conductivity, cyclical heating, and cooling durability are described. Relationships between thermal properties and durability are discussed and several photographs of the concretes are given. It is shown that the heating and cooling durability of such a concrete which has a large thermal expansion coefficient or a considerable difference between the thermal expansion of coarse aggregate and the one of cement mortar part or aggregates of lower strength is very poor. The decreasing rates of bending strength and dynamical modulus of elasticity and the residual elongation of the concrete tested show interesting relations with the modified thermal stress resistance factor containing a ratio of bending strength and thermal expansion coefficient. The thermal stress resistance factor seems to depend on the conditions of heat transfer on the surface and on heat release in the concrete. (auth)

Theoretical Physics

3121 NP-8060

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

A SIX-DIMENSIONAL INTERPRETATION OF ELECTRODYNAMICS AND NUCLEAR INTERACTIONS. J. Rayski. 1959. 15p. (P-379).

It is proposed that the traditional 4-dimensional manifold is not sufficient to describe a satisfactorily physical reality. An attempt is made to show the usefulness of a six-dimensional approach for interpreting, from a uniform viewpoint, several properties of matter regarded hitherto as primary and heterogeneous. It is assumed that the six-dimensional manifold is riemannian but singular. (W.D.M.)

3122

REDUCED WIDTHS FOR DEUTERON EMISSION CALCULATED USING THE NUCLEAR SHELL MODEL. M. Micu and A. Săndulescu. Acad. rep. populare Romîne, Inst. fiz atomică şi Inst. fiz. Studii cercetări fiz. 10, 257-76(1959). (In Rumanian)

Deuteron emission by a complex nucleus was studied using the shell model of the nucleus. Analytical expressions were obtained for reduced widths in the case where there are n equivalent nucleons outside a closed layer, and also in the case where there is only one nucleon. Each expression is obtained for the case of two extreme couplings LS and jj of the shell model. The results obtained are compared with experiments on the reactions $He^5 \rightarrow T + D$ and $Li^5 \rightarrow He^3 + D$. (tr-auth)

3123

SCATTERING INTEGRAL EQUATIONS IN HILBERT SPACE. Alberto Galindo Tixaire (Junta de Energia Nuclear, Madrid). Helv. Phys. Acta 32, 412-22(1959).

The mathematically and physically rigorous theory given by Jauch for the multichannel scattering systems is extended. Several integral representations of the Möller operators are obtained which are related to three integration methods: Riemann, Cauchy, and Riemann-Stieltjes integrals of operator valued functions. Three types of integral equations for the ingoing and outgoing waves within Hilbert space are derived. Their validity range is studied. Reasonable conditions on the channel interaction hamiltonians are given in order to justify them. The results apply with a wide class of "switching factors." The Lippmann-Schwinger equations appear as formal solutions of the RS-integral equations outside Hilbert space. (auth)

3124

BRUECKNER THEORY AND THE SHELL MODEL EFFECTIVE POTENTIAL. E. J. Squires (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 13, 224-34(1959) Oct. (2).

A discussion is given of the properties of the shell model effective potential obtained from Brueckner theory. Correction terms to the simple picture, in which the effective potential is just the Brueckner t matrix, are indicated explicitly for certain cases and their origin discussed. Analogy with known properties of the t matrix for infinite nuclear matter suggests that some of these corrections are of importance. It is suggested that while there may be some meaning to the concept of a simple effective potential in certain situations, the idea is not of general applicability. (auth)

3125

RENORMALIZATION OF A PARITY NON-CONSERVING THEORY. C. H. Albright, R. Haag, and S. B. Treiman (Princeton Univ., N. J.). Nuovo cimento (10) 13, 1282-4 (1959) Sept. 16.

A renormalization of Sekine's work on the construction of a parity non-conserving theory involving renormalization constants is given for the lowest order perturbation approximations. (C.J.G.)

3126

PRELIMINARY REMARKS ON A CONSEQUENCE OF THE TWO-CENTERS MODEL OF MULTIPLE MESON PRODUCTION. V. Petržílka (Charles Univ., Prague). Nuovo cimento (10) 13, 1300-1(1959) Sept. 16.

It is shown possible to determine the values $\bar{\Theta}$ and $\bar{\gamma}$ from equations in the two-center model of multiple meson production by using for the evaluation of γ_0, γ_1, and γ_2 the relations given in the theory. (C.J.G.)

3127

ON LARGE ANGLE PAIR PRODUCTION AND THE LIMITS OF VALIDITY OF ELECTRODYNAMICS. G. Poiani and I. Reina (Università, Trieste, Italy and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). Nuovo cimento (10) 13, 1302-5(1959) Sept. 16.

It is shown through comparison of experimental results in different kinematic situations that one could lower considerably the uncertainty coming from the nonperfectly known charge distribution of the target proton and increase

the effect of an eventual breakdown of electrodynamics at small distances. (C.J.G.)

3128

PROPOSED DIRECT TEST OF THE UNCERTAINTY PRINCIPLE. P. R. Ryason (California Research Corp., Richmond). Phys. Rev. 115, 784-5(1959) Aug. 15.

The behavior of single particles is a central issue in the interpretation of the quantum theory. Yet, the observation of single particles under well-controlled conditions has been difficult. Field-ion and field-emission microscopy permit the ready observation of single particles. It is proposed to test the relation $\Delta E \Delta t \approx \hbar$ by the pulsed-field desorption of single particles from the tip of a field-emission microscope. The conditions for such an experiment are briefly discussed. (auth)

3129

ADIABATIC INVARIANTS OF PERIODIC CLASSICAL SYSTEMS. C. S. Gardner (Stanford Research Inst., Menlo Park, Calif.). Phys. Rev. 115, 791-4(1959) Aug. 15.

Recently there has been renewed interest in adiabatic invariants of simply-periodic classical systems subject to perturbation by slow variation of parameters. It has been shown that if the system varies slowly from one steady state to a different steady state, the appropriate adiabatic invariant is constant to an arbitrarily high order in a slowness parameter. It is shown how these and similar results may be derived by systematic use of a technique of perturbation theory of classical Hamiltonian systems. The method is essentially iteration of the transformation to action and angle variables. (auth)

3130

THEORY OF THE VECTOR INTERACTION WITH A CONSERVED CURRENT AND THE BETA DECAY OF $Na^{24}-Al^{24}$ NUCLEI. Claude C. Bouchiat (Princeton Univ., N. J.). Phys. Rev. Letters 3, 516-18(1959) Dec. 1.

An attempt was recently made to estimate the contribution of isotopic spin impurities introduced by Coulomb interaction between protons. The relevant Coulomb matrix elements were calculated with wave functions given by j–j coupling shell model. The calculated and experimental Fermi matrix elements were compared for the β decay of the $T = 1$, $J = 4^+$ state of Na^{24} to the $T = 0$, $J = 4^+$ of Mg^{24}. The experiments on Na^{24} were found to agree only with a value of M_F smaller than 10^{-3} while the theoretical estimate yields a value of $\sim 1.3 \times 10^{-2}$. A possible experiment which could be used to explain these discrepancies is described. Utilizing the theory of vector interaction with a conserved current, the Fermi matrix element is calculated for the β decay of the ground state of Na^{24} to the ground state of Al^{24} from which the following equation was obtained: $A^{(+)} + A^{(-)} = 0$. (C.J.G.)

3131

BETA DECAY AND WEAK INTERACTIONS. Ya. A. Smorodinskii. Uspekhi Fiz. Nauk 68, 653-62(1959) Aug. (In Russian)

A theoretical survey of β decay and weak interactions, given at the Ninth All-Union Conference on Nuclear Spectroscopy, Jan. 1959, Khar'kov, is presented. (R.V.J.)

3132

THE INFLUENCE OF CONFIGURATION MIXING ON SHELL MODEL STUDIES OF C^{14}, O^{14}, AND N^{14} NUCLEI. Karl Ott (Max-Planck-Institut für Physik, Göttingen, Ger.). Z. Naturforsch. 14a, 769-83(1959) Sept. (In German)

In the analysis of the problem of the long β-decay lifetime of the C^{14} nucleus and the sign and magnitude of the N^{14} quadrupole moments, the influence of d-mixing in the shell model wave function of which $A = 14$ is calculated. The nucleon-nucleon interaction was adjusted on the basis of two-nucleon data. The adjustment is possible for two strong interaction types different from each other: (1) strong central force with long-range weak tensor force and (2) weak central force with short-range strong tensor force. For both of the two interaction expressions the deviation of the p-shell result from the empirical data is so small that they fall into the large region of calculation with configuration mixing contribution, so that an exact agreement by neglecting higher configurations must be considered incidental. (tr-auth)

3133

ELECTRON-ELECTRON SCATTERING AND QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. G. V. Avakov. Zhur. Eksptl'. i Teoret. Fiz. 37, 848-9(1959) Sept. (In Russian)

Electric and magnetic form factors are determined by comparing the experimental and theoretical data, assuming that electron interactions are of vector and gradient invariance up to considerable energies. Taking into account the electron form factor, the magnetic form factor also should be considered as different from zero. After the φ and f functions were found, their ratio could be compared with the magnitude μ which was derived from electron scattering on α particles. (R.V.J.)

3134

ELECTRIC QUADRUPOLE γ TRANSITIONS IN EVEN-EVEN NUCLEI. N. N. Delyagin (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 849-51(1959) Sept. (In Russian)

The excited states of even-even nuclei with 2^+ characteristics, whose decay is achieved by electric quadrupole γ radiation, are investigated. The experimental data on the lifetimes of these states enable one to calculate, for the corresponding E2 γ transitions, the probability factors B(E2), equal to the square of matrix element transition. Thus, the bond magnitudes B(E2) and the respective excited states E are determined. Studies were made over a wide range of mass numbers, from $A = 46$ (Ti) to $A = 198$ (Pt). Separate correlations were made of the magnitudes of B(E2) and E for isotopes of various elements. It was observed that for isotopes of all elements examined the increase of E always corresponds to reduced B(E2). Such dependence of B(E2) on E was observed not only in nuclei with large deformation parameters but it was general for the even-even nuclei. The correlation between the B(E2) and E magnitudes is presented graphically using the data for isotopes of Ru, Gd, W, and Pt. For the larger group of nuclei (at mass numbers $150 < A < 190$ and $A > 222$) lower excitations of even-even nuclei are interpreted as rotational. The nuclei outside the above mass number range are considered within generalized nuclear models as spherically symmetric, and their excitations are interpreted as the result of quadrupole vibrations. Absence of a quantitative theory for such oscillations complicated verification of the postulation. (R.V.J.)

3135

NUMERICAL SOLUTION FOR STATIC DISPERSION RELATIONS FOR P-WAVE PHOTOPRODUCTION. L. D. Solov'ev and G. N. Tentyukova (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 889-90(1959) Sept. (In Russian)

The method of converging linear singular integral equations, proposed by R. Omnes (Nuovo cimento (10) 8, 316 (1958)), with normalized Fredholm equations was used for

deriving a numerical solution for static dispersion relations for P-wave photoproduction. (R.V.J.)

3136

ASPECTS THÉORIQUES DE LA SYSTÉMATIQUE DES NOYAUX ATOMIQUES. (Theoretical Aspects of the Systematics of Atomic Nuclei). Monograph No. 1. M. Demeur. Brussels, Institut Interuniversitaire des Sciences Nucléaires, [1957.] 91p.

The text is presented of a cycle of conferences held in Feb. and March 1957, by the Theoretical Group of the Interuniversity Institute of Nuclear Science. Emphasis was placed on the study of deformed nuclei. The question of nuclear models and the hypotheses on which they are based occurred. In the first part, three principal points were dealt with: (a) examination of several general properties chosen in accordance with the general subject, (b) a brief study of the layer structure of the nucleus, and (c) a study of the spheroidal model. The first part constituted a preparation for the second part which is devoted to different aspects of the collective model. Three aspects are discussed: rotation and vibration levels, some consequences of the model (first odd-parity state, electromagnetic moments, isotopic displacement, particle-rotation coupling, beta and gamma transitions, and moment of inertia), and study of three phenomena for which deformation of the nucleus incurs typical results: coulomb excitation, alpha radioactivity, and fission. (T.R.H.)

REACTOR TECHNOLOGY

General and Miscellaneous

3137 ANL-6024

Argonne National Lab., Idaho Falls, Idaho.

DESIGN AND HAZARDS REPORT FOR THE ARGONNE FAST SOURCE REACTOR (AFSR). G. S. Brunson. June 1959. 65p. Contract W-31-[109]-eng-38. OTS.

The Argonne Fast Source Reactor is designed to operate at low power (nominally 1000 watts) to supply neutron fluxes, both fast and thermal, for laboratory experiments. It is built around a cylindrical core (with vertical axis) of solid, highly enriched uranium approximately $4\frac{1}{2}$ in. in diam. by $4\frac{1}{4}$ in. high. The blanket is of solid depleted uranium with a minimum thickness of eight in.; its outer form is cylindrical, $20\frac{5}{8}$ in. in diam. by $20\frac{5}{8}$ in. high. The reactor, contained in a shield of high density concrete of minimum thickness $4\frac{1}{2}$ ft, is freestanding on the floor of the reactor building. A graphite thermal column $4 \times 4 \times 6$ ft is provided. All control and safety mechanisms are located in a pit beneath the reactor. The hazards associated with operation of the reactor have been analyzed. A number of potentially dangerous circumstances were studied to determine the probable severity of the resultant excursions. As an upper limit, a detailed study was made of the extreme case in which the reactor, overloaded by five kilograms of U^{235}, goes critical at the air cylinder speed of 18 in./min. It is estimated that the excursion would amount to 3.6×10^{17} fissions. This is expected to destroy the core and eject all core material into the pit where it burns, greatly adding to the total energy of the excursion. No rupture of reactor shield or building is expected. The reactor pit and reactor building will be heavily contaminated and some radioactive material will escape from the building. It is nearly certain that the maximum radiation dose to personnel outside the reactor building will not exceed 15 roentgens. (auth)

3138 ANL-6067

Argonne National Lab., Lemont, Ill.

ISOTOPIC ABUNDANCE AND THE VARIATION OF η IN IRRADIATED NUCLEAR FUELS CONSISTING INITIALLY OF COMBINATIONS OF Th^{232}, U^{238}, AND U^{235}. J. C. Carter and R. C. Howard. Oct. 1959. 71p. Contract W-31-109-eng-38. OTS.

The abundances of the significant isotopes and the variation of η during the irradiation of a nuclear fuel, which initially consists of combinations of U^{235}, U^{238}, and Th^{232}, are presented. (auth)

3139 IDO-16562

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

HEAT TRANSFER IN ETR FUEL ASSEMBLIES FOR CYCLE 13. V. A. Walker. Nov. 6, 1959. 24p. Contract AT(10-1)-205. OTS.

The neutron flux distribution was measured and the heat transfer calculations were re-examined for ETR Cycle 13 because several large experiments had been inserted in the ETR core. In addition, the importance of fuel core alloy thicknesses greater than the nominal was determined by calculation. The maximum calculated wall temperature in the ETR during Cycle 13 is 395°F with reactor power at 175 Mw and an average fuel element coolant velocity of 35 ft/sec, i.e., 55 psi pressure drop across the core and an inlet water temperature of 110°F. This temperature is about 30°F above the saturation temperature but is not expected to produce a hazardous condition during operation. Allowing the fuel core alloy thickness to be 8 mils greater than the nominal $\frac{1}{2}$ in. from the bottom of the alloy raises the calculated wall temperature at this point by only 20°F; this wall temperature is still less than that near the horizontal center-line. Therefore, an 8 mil "dog-bone" is permissible in the fuel element fabrication. (auth)

3140 IGR-209(RD/R)

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

A METHOD FOR ESTIMATING FAST-REACTOR ONE-GROUP CROSS-SECTIONS. B. M. Segal. July 30, 1959. 37p. BIS.

A method for estimating one-group cross sections with some degree of spectrum-dependence for application to fast reactor surveys is presented. Cross sections are given in the form of curves which represent a condensation of multigroup diffusion calculations. The accuracy of the method for critical mass calculations is discussed and the errors involved are listed. (C.J.G.)

3141 KAPL-M-SMS-102

Knolls Atomic Power Lab., Schenectady, N. Y.

MODIFICATION OF IBM-650 EMERGENCY COOLING PROGRAM TO INCLUDE REACTOR KINETICS. M. J. DaCosta. Sept. 11, 1959. 34p. Contract W-31-109-Eng-52. OTS.

Two major modifications were added to the digital computer program used for the evaluation of emergency cooling since KAPL-M-SMS-87 was issued. A brief description of these changes and summary of the input required are given. Modifications provide for reactor kinetics and boiler steam side heat transfer coefficient. (W.D.M.)

3142 KAPL-RDTR-308(Pt.V)

Knolls Atomic Power Lab., Schenectady, N. Y.

TIME-TEMPERATURE EXCURSIONS OF FILM BLANKETED FUEL ELEMENTS AS MEASURED BY THERMOCOUPLES AND VOLTAGE TAPS. Test Report. C. L. Gregory. [1958]. 31p. OTS.

Tests were made on electrically-heated ¼ in. OD stainless steel tubes to determine the time-temperature response at various positions along the tube for departure from nucleate boiling conditions (film blanketing). Exit conditions were subcooled. Pressures varied from atmospheric to 2000 psia. Wall-temperatures were monitored with thermocouples. Resistivity changes were used to measure temperatures by means of voltage taps. It was found that the size of the area going into film blanketing was greatly reduced as pressure was increased. This indicates that accurate location of sensors used for burnout detection is required at higher pressures. The results of this study were utilized in the location of surface thermocouples on the test sections of SAR Thermal and Hydraulic Design Test 308. The behavior of voltage taps during this program was found to be erratic. (auth)

3143 NAA-SR-Memo-2213
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THERMAL STRESSES FROM RADIAL EXPONENTIAL HEAT GENERATION IN THE THERMAL SHIELDS, VESSEL WALL AND BIOLOGICAL SHIELD. Charles O. Peinado. Oct. 25, 1957. 11p. OTS.

Studies were made to determine the maximum thermal stresses from radial exponential heat generation in organic moderated reactor thermal shields, vessel wall, and biological shield. The maximum thermal stresses in the thermal shield and vessel wall at 45.5 Mw are: inside thermal shield, σ_p = 6,370 psi; vessel wall, σ_θ = 3,220 psi; and outside thermal shield σ_θ = 5,270 psi. The maximum thermal stresses in the biological shield at 45.5 Mw indicate the concrete will develop cracks near the inside or outside surface. (W.L.H.)

3144 NAA-SR-Memo-2278
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REQUIRED LOADING FOR THE OMRE. R. O. Williams. Nov. 15, 1957. 5p. OTS.

The critical mass and reactivity addition per element was experimentally determined. The core loading was twenty-nine elements with an estimated reactivity of 6.8% at 300°F. The estimated worth of an additional element at this loading is 0.67% so that loading to 31 elements yields a reactivity of 8.2%. The reactivity of this core at 500°F should be about 1% higher, yielding a gross reactivity of 9.2%. Xenon and samarium poisoning account for about 3 to 5% reactivity so the net available for control and burnup is on the order of 5.7 to 6.2%. (W.L.H.)

3145 NAA-SR-Memo-2441
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ENDURANCE TEST OF MARK II CONTROL ROD DRIVE. R. J. Tuttle. Jan. 23, 1958. 3p. OTS.

An endurance test was made to determine the reliability of the Mark II control rod drive. The control rod drive unit completed 1300 scrams and the results are presented. (W.L.H.)

3146 NAA-SR-Memo-2919
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DEVELOPMENT OF A FAST SCRAM INSTRUMENT OF OMR CRITICAL EXPERIMENT. L. S. Beller. July 25, 1958. 15p. OTS.

The instrumentation scheme for the OMR Critical Facility requires a scram circuit that operates within five milliseconds whenever a predetermined power level is reached. An instrument meeting these requirements was built and tested. Its detecting element is a scintillator sensitive to gamma radiation. (W.L.H.)

3147 NAA-SR-Memo-2959
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ESTIMATED PERFORMANCE OF OMR FUEL ELEMENTS BASED ON ALLOY COMPOSITIONS NEAR U-3.5Mo. H. Pearlman. [1958]. Decl. Sept. 17, 1958. 27p. OTS.

A review was made of factors affecting attainment of high burnup in U–3.5 Mo–0.5 Si fuel plates, clad in Al alloy, in an Organic Moderated Reactor. The phenomenon of fuel swelling under irradiation is determined to be the primary limitation on fuel element life. Other factors considered are: coolant-cladding interaction, mechanical properties of fuel and of cladding, behavior of fuel under thermal cycling, and over-all structural integrity of the fuel element. (W.L.H.)

3148 NAA-SR-Memo-3119
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRESSURE DROP MEASUREMENTS OF OMRE AND OMR TYPE FUEL ELEMENTS ADAPTED TO OMRE. R. R. Hargrove. Sept. 9, 1958. 11p. OTS.

Using water as the hydraulic medium the pressure drop as a function of flow rate across the following fuel elements was determined: standard OMRE fuel element, OMR-HB; an OMR fuel element with five high burnup plates, and OMR-HT; and OMR type heat transfer fuel element. (W.L.H.)

3149 NAA-SR-Memo-3241
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
METHODS FOR CALCULATING THE HEAT GENERATED IN A REACTOR CORE. H. O. Whittum. Nov. 13, 1958. 14p. OTS.

Methods used to determine the heat generated in the structural materials of the Rover core are described. (W.L.H.)

3150 NAA-SR-Memo-3296
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THROTTLING AND BLOCKING TESTS FOR 2-INCH P-K PAUL VALVE. W. F. Marten. Nov. 21, 1958. 10p. OTS.

Performance characteristics of a 2-in. ball-type throttling valve were determined to evaluate the effectiveness of this type of valve in Na service. The results of the Na throttling tests are shown in terms of % valve opening versus % Na flow for both 500 and 950°F Na. Changes in cover gas pressure were found to have no effect on the valves' throttling characteristics. (W.L.H.)

3151 NAA-SR-Memo-3304
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MEASUREMENT OF TOTAL FALL TIME AND DIFFERENCES IN ACCELERATION FOR A CONTROL ROD FALLING IN AIR AND IN ORGANIC, OMR CRITICAL EXPERIMENT. L. S. Beller. Dec. 4, 1958. 7p. OTS.

Measurements were made of the total fall time for control rods falling in air and in organic coolant for hazards calculations. Results of measurements of the time required for the entire instrumentation and safety system of the organic moderated reactor to function are summarized. (W.L.H.)

3152 NAA-SR-Memo-3330
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OCR FUEL AND CLAD SURVEY. H. I. Raiklen. Jan. 14, 1959. 20p. OTS.

A survey is presented on possible fuel and cladding materials for the Organic Cooled Reactor. (W.L.H.)

3153 NAA-SR-Memo-3651
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
BURNUP OF OMR FUEL ELEMENTS, HB-1 AND HT-1. G. D. Calkins. Mar. 13, 1959. 4p. OTS.

Preliminary results from Battelle, on the first OMR Fuel Elements, indicate that the maximum burnup was ~0.22 at. % U for the high burnup element and 0.20 at. % U for the heat transfer element. In both cases, the maximum burnup occurred at the edge of the fuel plate facing the center of the reactor core at an area about one-half to two-thirds down the length of the fuel plate from the outlet or upper end. (auth)

3154 NAA-SR-Memo-3866
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CONTROL ROD GUIDE FOR OMR CRITICAL ASSEMBLY. H. E. Scarlett. Aug. 12, 1959. 6p. OTS.

In the original concept of the OMR Critical Assembly it was intended to use control rods moving vertically in dry thimbles. More recent OMR designs employ "wet" rods moving directly in the organic. A guide for the "wet" control rods was designed and tested. This design employs a combination of an upper guide that is attached to the upper grid plate and a three bladed, Y-shaped lower guide attached to a lower grid plate extending vertically to overlap the upper guide. (W.L.H.)

3155 NAA-SR-Memo-3903
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MOLECULAR WEIGHT OF HIGH BOILERS IN OMRE AND IN-PILE LOOP IRRADIATED POLYPHENYL COOLANTS. R. T. Keen. June 23, 1959. 21p. OTS.

In both the in-pile loop experiments and OMRE operation, the average molecular weight of the high boiler (HB) was found to increase linearly with increasing reactor operations. A comparative summary of initial and final molecular weights in in-pile loop experiments and OMRE experiments is presented. (W.L.H.)

3156 NAA-SR-Memo-3960
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CORE CALCULATIONS FOR OMRE ALTERNATE II PROPOSAL. J. Stewart and F. Fillmore. June 4, 1959. 15p. OTS.

Studies were performed to select a fuel element for the OMRE-II core that can be fabricated with the present technology and withstand a maximum surface temperature of 850°F. A core configuration that will provide facilities for accommodating two 5½-in. by 5½-in. fuel elements in enclosed test loops was determined, a lattice spacing that will provide a maximum thermal neutron flux, allow nucleate boiling, and not exceed the present 16 Mw heat exchanger capacity was studied. (W.L.H.)

3157 NAA-SR-Memo-4019
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REDUCTION OF RADIONUCLIDE CONCENTRATIONS IN ORGANIC REACTOR COOLANTS. W. P. Kunkel and P. J. Legendre. June 17, 1959. 25p. OTS.

Studies were made to establish the specifications for the reduction of radioactivity concentrations in organic coolants: specific removal requirements for radionuclides produced by corrosion, recoil, and initial impurities are examined for several OMR design concepts. (W.L.H.)

3158 NAA-SR-Memo-4042
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
STUDY OF INHERENT SHUTDOWN OF OMR CRITICAL ASSEMBLY WITH CYLINDRICAL FUEL ELEMENTS. R. J. Tuttle. June 17, 1959. 13p. OTS.

The inherent shutdown behavior of the OMR Critical Assembly fueled with cylindrical fuel elements was determined. (W.L.H.)

3159 NAA-SR-Memo-4103
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
INSTRUMENTATION AND CONTROL OF THE OMR CRITICAL REACTOR. H. W. Slocomb. July 9, 1959. 17p. OTS.

The circuits and control equipment used on the OMR Critical Reactor are discussed along with the considerations involved in the selection of these components, and the operating experience to date. (W.L.H.)

3160 NAA-SR-Memo-4157
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OCR POWER DISTRIBUTIONS. L. M. Maki and R. H. Sevy. July 22, 1959. 30p. OTS.

Studies were performed to determine the power peaking factors for the 300 Mw(e) OCR during the life of the first and subsequent core loadings. Studies were also made to determine the changes in isotope concentration of the fuel. (W.L.H.)

3161 NAA-SR-Memo-4178
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
NATURAL CONVECTION COOLING SYSTEM FOR THE FUEL HANDLING CASK. J. D. Wilde. July 27, 1959. 19p. OTS.

Studies were made to determine whether the present fuel handling cask design is adequate to protect the fuel element when power for forced circulation cooling is lost during transfer. The maximum temperatures in the fuel element and cask were determined. Also determined was the pressure drop and power consumption when monoisopropyldiphenyl is circulated through the system at the rate of 5 gpm. (W.L.H.)

3162 NAA-SR-Memo-4201
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CALIBRATION OF OMR TEST ELEMENT ANEMOMETERS. M. Starr. July 31, 1959. 11p. OTS.

Calibration curves for the three-lead hot wire anemometers installed in the OMR test elements were made. Results are presented. (W.L.H.)

3163 NAA-SR-Memo-4223
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PROBLEM AREAS IN SAFETY ANALYSIS OF SGR AND OMR REACTORS. Roy A. Axford. [1959]. 14p. OTS.

Several problem areas relevant to the safety of SGR and OMR reactor systems and in which theoretical analysis is required are delineated. The subjects are varied and include not only detailed investigations of the basic physical phenomena pertinent to safe reactor operation, but also the interplay of the physical phenomena which govern the stability of the full reactor system. The range of topics com-

prise four categories: (1) a survey of the practical problems relating to the safety of those reactor types and existing critical facilities of interest, (2) the mathematical treatment of the kinetic mechanisms and phenomenology of the full reactor system, (3) the analytic treatment of the significant feedback mechanisms and of those portions of the fields of fluid dynamics and heat transfer particularly relevant to reactor safety considerations, and (4) the construction of fundamental theories of the basic physical effects which govern the kinetic behavior of various reactor systems. Each of these categories is discussed. (auth)

3164 NAA-SR-Memo-4263
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
TECHNIQUE FOR GROSS FLUX MEASUREMENTS IN THE OMR CRITICAL ASSEMBLY. R. J. Tuttle. Aug. 17, 1959. 6p. OTS.

A technique was developed for measuring the gross neutron flux distributions in the OMR Critical Assembly using Mn-alloy wires. Manganese-alloy (Mn–20%Cu–19%Ni) wire segments, one-half inch long, are loaded into Al or Cd tubing, which is then placed in a stainless steel tube inserted in the desired location in the critical assembly. After irradiation, the wires are removed and the 2.6 hour half-life induced beta activity is counted using scintillation counters. The count-time for each wire is automatically extended as the radioactivity of a monitor wire decays, thus correcting for the radioactive decay. This method yields directly the relative activation of each wire. (W.L.H.)

3165 NAA-SR-Memo-4265
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REVIEW OF SEED AND BLANKET POTENTIALITIES FOR OMR CORES. T. J. Connolly. Aug. 17, 1959. 9p. OTS.

A comparison is made of the seed and blanket core design concept and a slightly enriched concept to determine their relative potential for improving core performance of an OMR. The conclusion is that the slightly enriched core has an advantage over the seed and blanket core. (W.L.H.)

3166 NAA-SR-Memo-4293
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
BANKED CONTROL ROD CALCULATIONS BY SMALL SOURCE THEORY. C. Warner. [1955]. 14p. OTS.

Calculations were made to study the effect of fuel homogenization and control rod interaction on lattices. (W.L.H.)

3167 NP-8071
Lockheed Nuclear Products, Marietta, Ga.
OPERATING HISTORY OF THE CRITICAL EXPERIMENT REACTOR FOR THE YEAR 1958. M. A. Dewar. Oct. 1959. 46p. Contract AF33(600)-38947. (NR-71).

The Critical Experiment Reactor became critical on June 9, 1958. After the startup tests, the reactor was taken critical 177 times in support of the Radiation Effects Reactor program. Critical and operational loadings for the Radiation Effects Reactor, rod calibrations, and temperature, void, and other reactivity coefficients were determined at the Critical Experiment Reactor. Extensive reactor operator training was conducted. (auth)

3168 RM-2396(RAND)
RAND Corp., Santa Monica, Calif.
ON CONTROL OF REACTOR SHUTDOWN INVOLVING MINIMAL XENON POISONING. Milton Ash, Richard E. Bellman, and Robert E. Kalaba. June 26, 1959. 18p.

An application of the theory of dynamic programming to the control of reactor shutdown involving minimal xenon poisoning is presented. After a high-flux thermal nuclear reactor is shut down, the concentration of fission product xenon may rise for many hours as a result of the decay of fission product iodine into xenon-135. This results in reactor poisoning and may, with consequent loss of efficiency, postpone the time at which the reactor may be restarted. This poisoning may be minimized by carefully controlling the rate at which the neutron flux is decreased during the shut-down operation. The study shows how dynamic programming, assisted by highspeed digital computers with large memories, determines optimal control in this situation. (auth)

3169 TAB-57
[Oak Ridge National Lab., Y-12 Area, Tenn.]
HEAT TRANSFER ANALYSIS OF 3.5 FOOT SQUARE CYLINDER REACTOR. W. C. Cooley. July 26, 1950. Decl. Oct. 9, 1959. 5p. OTS.

Heat transfer calculations were made for a sodium cooled 3.5 ft cylindrical reactor with a volume % moderator of 66.7% and pin type fuel elements. It is concluded that the design of a 3.5 ft reactor for 500 Mw holds promise of achievement within a reasonable amount of development time. (W.D.M.)

3170 TID-3525(Rev. 1)
Technical Information Service Extension, AEC.
REACTOR SAFETY. A Literature Search. Richard J. Smith, comp. Nov. 1959. 41p. OTS.

This bibliography includes 269 references to unclassified AEC research and development reports and 108 references to non-AEC reports. These references include information on reactor systems, materials, and operation designed to provide maximum safety for the reactor, reactor personnel, and environs. (J.E.D.)

3171 WAPD-217
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
THE CALCULATION OF PRESSURE DROP AND FLOW DISTRIBUTION WITHIN A REACTOR VESSEL IN A PRESSURIZED WATER NUCLEAR REACTOR SYSTEM. J. S. Busch, L. L. Lynn, and C. F. Bonilla. Aug. 1959. 42p. Contract AT-11-1-GEN-14. OTS.

A collection of formulas is presented for calculating the pressure drops and flow distribution within the nonreactive (exclusive of the fuel element) portion of a pressurized water nuclear reactor vessel. Numerous examples illustrate the use of the formulas presented. Calculations based on the information presented in this report have been found to agree well with experimental data. (auth)

3172
ABSOLUTE METHOD OF MEASUREMENT OF THERMAL NEUTRON FLUX. Horia Hulubei, C. Beşliu, Al. Berinde, M. Ivaşcu, and N. Martalogu (Universitatea "C. I. Parhon," Bucharest). Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 223-7(1959). (In Rumanian)

Impregnated NIKFI nuclear emulsions were used because their B and Li concentrations were known to a precision of 1%; they were exposed successively to several portions of the flux to be studied, during time intervals differing from one portion to the other. By representing the surface density of the tracks due to boron as a function of the irradiation time, the absolute value of the thermal neutron flux was found by means of the slope. The precision of the method is 3%. A procedure is also given for controlling

the accuracy of the measurement as well as a new method of scanning. (tr-auth)

3173

CONTACT VERIFICATION INDICATOR FOR SCRAM SAFETY RODS IN THE KARLSRUHE REACTOR FR 2. N. Hemmer and N. Reinert. Arch. tech. Messen Lfg. 285, R101-16(1959) Oct. (In German)

An apparatus is described which, by purely electrical methods, gives very accurately the correct contact break point for the drive of the carrier magnet within the check zone. With this apparatus the magnet drive does not approach the rotor. The apparatus also indicates whether the absorber part of the rods is still controlled by the magnet. The apparatus is monitored for current interruptions. (tr-auth)

3174

NUCLEAR PROBLEMS AND STRUCTURAL QUESTIONS IN THE CONSTRUCTION OF REACTORS. P. Eversheim (Vereinigten Leichtmetall-Werke GmbH., Bonn). Atompraxis 5, 362-7(1959). (In German)

The most important physical and thermal properties of the various structural elements of a reactor, which are exposed to nuclear radiation, are described, and the conditions for canning materials, properties of corrosion, and the effect of radiation on structural materials are discussed. Metallurgical problems are discussed in addition. (auth)

3175

SODIUM—REACTOR COOLANT. B. L. Harbourne (United Kingdom Atomic Energy Authority Risley, Lancs, Eng.). Chem. & Proc. Eng. 40, 347-51(1959) Oct.

The advantages of using liquid sodium for a reactor coolant are discussed. The various practical considerations involved in designing sodium-cooled reactor systems such as sodium handling, materials selection for the circuit, and the destructive properties of sodium on the circuit are discussed. (C.J.G.)

3176

CALCULATION OF THE CONSTANTS IN THE TWO AND THREE GROUP NEUTRON THEORY. Guillermo Velarde (Junta de Energia Nuclear, Madrid). Energia Nuclear (Madrid) 3, No. 11, 46-66(1959) July-Sept. (In Spanish)

Formulas are given for the hand calculation of the thermal and fast nuclear constants in the two and three group neutron theory. (J.S.R.)

3177

SAFETY FACTORS IN NUCLEAR REACTORS. Francisco Oltra Oltra (Junta de Energia Nuclear, Madrid). Energia Nuclear (Madrid) 3, No. 11, 74-82(1959) July-Sept. (In Spanish)

The safety considerations in the design of nuclear reactors can be divided into nuclear considerations and engineering considerations. The nuclear and engineering factors are tabulated, and the method of calculating each is briefly indicated. The application and utilization of these factors in the calculations of reactors are discussed and examples are given. (J.S.R.)

3178

NEUTRON FLUX AND VOID DISTRIBUTION IN BWR. T. Kawai, K. Arai, S. Terasawa, and T. Kanai (Hitachi, Ltd., Japan). J. Atomic Energy Soc. Japan 1, 28-39 (1959) June. (In Japanese)

Different methods are introduced to solve the two group diffusion equations, which involve the mutual interaction of the power, void, and control rod distribution in the BWR. In the numerical examples by digital computer (HIPAC-1 and IBM-650) calculations given, the results of one-dimensional forward method, backward method, and two-dimensional backward method are compared. The Peaceman-Rachford method is used to accelerate the convergence in the two-dimensional backward method. The utility of the backward method is particularly evident in two-dimensional studies. The correlative application of the forward method with the backward method seems to be necessary in the actual design of large boiling water reactors. (auth)

3179

SELF-REGULATION OF THE NUCLEAR REACTOR. E. Takeda (Tokyo Inst. of Tech.). J. Atomic Energy Soc. Japan 1, 70-81(1959) June. (In Japanese)

A review is presented on the power excursion experiments SPERT, KEWB, BORAX, and TRIGA. Reference is also made to theoretical explanations of data obtained in the experiments. (auth)

3180

RADIOACTIVE ARGON RELEASED FROM REACTORS. M. Okano and M. Otsuka (Inst. of Physical and Chemical Research, [Tokyo]). J. Atomic Energy Soc. Japan 1, 95-102(1959) (In Japanese)

The conditions for monitoring large amounts of radioactive argon being continuously released from reactors were investigated. According to the present regulation the maximum permissible concentration of Ar^{41} in air is 5×10^{-7} μc/ml occupationally. It is commonly regarded as necessary to detect the concentration of Ar^{41} up to about 10^{-8} μc/ml in the case of monitoring for public living in the neighborhood of a reactor site. The possibility of monitoring for the public with γ detectors of the standard type is discussed. The possibility of detecting the contribution of Ar^{41} to the genetic dose of the population is discussed. (auth

3181

ON THE CONSTRUCTION OF THE TOKAI LABORATORY OF THE JAPAN ATOMIC ENERGY RESEARCH INSTITUTE. M. Ōmura, S. Nakamura, H. Oike, and H. Nōmi (Japan Atomic Energy Research Inst., [Tokyo]). J. Atomic Energy Soc. Japan 1, 143-68(1959). (In Japanese)

Various aspects of the Tokai laboratory site, the plan of construction, and the outlines of the principal building facilities such as JRR-1, the synthesis laboratory, JRR-2, the 10 kc Co^{60} and linac radiation facilities, the hot laboratory, and JRR-3 are described. (auth)

3182

CALCULATION OF IRRADIATION AND GAMMA RAY HEATING ON STRUCTURAL MATERIALS OF BWR. [PART] I. I. Ichino, T. Ōmura, M. Tokizawa, and H. Andō (Nippon Atomic Industry Group Co., Ltd.). J. Atomic Energy Soc. Japan 1, 289-98(1959). (In Japanese)

Calculations are presented on the radiation damage of structural materials by fast neutron and gamma bombardment and gamma heating of the pressure vessel of a boiling water reactor of 10 Mw(e) output. Estimates are made of the neutron flux in and out of the core, gamma flux, and gamma heating of the pressure vessel. (C.J.G.)

3183

G. E. C. CROSS-FLOW FUEL ELEMENT. Nuclear Eng. 4, 383-5(1959) Nov.

A design is given for a cross-flow stainless steel lenticular fuel element which is to be mounted transversely to the coolant channel. An advantage of the cross flow fuel

element is the decreased pressure drop which is estimated to be half that experienced with cluster elements for channel outputs corresponding to a fuel rating of 10 Mw/t. (C.J.G.)

3184

THERMAL INSTABILITY DUE TO GRAPHITE OXIDATION. P. J. Robinson and J. C. Taylor (United Kingdom Atomic Energy Authority, Sellafield, Cumb., Eng.). Nuclear Eng. 4, 400-3(1959) Nov.

Equations are given for determining the equilibrium temperature of graphite and air and the thermal stability of graphite under oxidation including the critical condition. Experimental results are given which confirm the theory. The ultimate course of a runaway is examined and the possibility of control over a runaway discussed. (C.J.G.)

3185

NEUTRON TEMPERATURE OF A MODERATOR COMPOSED OF SMALL AREAS OF VARYING TEMPERATURE. Eberhard Kern (Arbeitsgemeinschaft BBC-Krupp, Mannheim, Ger.). Nukleonik 1, 286-90(1959) Oct. (In German)

The moderator, which is present, for example, in a pebble-bed reactor, has the following properties. It is composed of numerous zones with various material temperatures. The zone diameters are smaller than or equal to the free path of the neutrons. With respect to their temperatures, the zones are mixed approximately homogeneously. For such a moderator a uniform neutron temperature is defined which represents the mean value of the material temperatures. In the mean value derivation the roots of the material temperatures are added. (tr-auth)

3186

SIMULATION OF THE STATIONARY FLUX DISTRIBUTION OF A REACTOR ON AN ANALOG COMPUTER. A. Kirchenmayer (Technische Hochschule, Stuttgart). Nukleonik 1, 290-5(1959) Oct. (In German)

The simulation of the stationary flux distribution was made by the difference method. A circuit was given by which the magnitude of a parameter (e.g., K_∞), can be adjusted to the eigenvalue for which a stationary state exists. The variation of the spatial fluctuating group constants is easily considered and its effects are directly readable. The accuracy is discussed and examples are given. (tr-auth)

3187

A METHOD FOR THE EXPERIMENTAL DETERMINATION OF THE BUCKLING OF A HETEROGENEOUS REACTOR STRUCTURE. A Ziegler (Siemens-Schuckertwerke AG., Erlangen, Ger.). Nukleonik 1, 295-305(1959) Oct. (In German)

The problem of the measurement of B^2 of a heterogeneous reactor structure in a partial volume which is smaller than the critical volume is considered. For the measurement this partial volume should be inserted as the central zone in a reactor so that with this addition a critical volume is produced. The two basic defects of such an arrangement are the deviations of the neutron spectrum and the flux density distribution in the component volume to be investigated from the behavior in a critical reactor with the same internal structure. A method is given to adjust the neutron spectrum and to synchronize the flux density distribution to that in the reactor. By a measurement method with exchangeable and rotating probes, various systematic errors were eliminated and non-symmetries were averaged out. The measurement accuracy obtainable must be sufficient to determine from the measurement in the heterogeneous system a better value for B^2 than one obtains from theory. A greater accuracy is obtainable also by comparison with a homogeneous solution which contains uranyl sulfate with a given enrichment and supplementary absorber with a concentration so balanced that a direct comparison of both systems is possible. An experimental method was given and theoretically proven. (tr-auth)

3188

STABILITY OF A CONTINUOUS-MEDIUM REACTOR. W. K. Ergen (Oak Ridge National Lab., Tenn.) and J. A. Nohel (Georgia Inst. of Tech., Atlanta). Reactor Sci. 10, 14-18(1959) July.

Sufficient conditions for the stability of a continuous-medium reactor are given under the assumptions that there is no mechanical vibration coupled with the oscillation of reactor power; that delayed-neutron effects may be neglected; and that hydrodynamic flow does not affect dynamic stability. The conditions given involve only known reactor parameters, and numerical examples are considered to complement the theory. (auth)

3189

REACTOR KINETICS FOR MULTI-REGION MULTI-FUEL REACTORS. H. L. Garabedian and P. von Herrmann (General Motors Corp., Warren, Mich.). Reactor Sci. 10, 36-43(1959) July.

On the basis of two-group diffusion theory the inhour and kinetic equations are derived for a reactor containing a different fissionable material in each of its two regions. The method of small perturbations is used in the derivation. The results are compared with inhour and kinetic equations that would be obtained by homogenizing the materials from both regions throughout the reactor. Methods for computing the parameters occurring in the equations are indicated. (auth)

3190

COMPOSITE REACTOR LATTICES. A. N. Buckler and C. Carter (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 10, 44-52(1959) July.

A procedure is presented for the homogenization of a large heterogeneous reactor consisting of a composite lattice of several different types of fuel rod immersed in a moderator. The properties of the composite lattice are expressed as suitable averages of the properties of single lattices containing only one type of fuel rod. (auth)

3191

THE CONCEPT OF COMPLEX RELAXATION TIME IN REACTOR DYNAMICS. Louis Gold (Edgerton, Germeshausen and Grier, Inc., Boston). Reactor Sci. 10, 53(1959) July.

A concept of complex relaxation times is introduced into reactor dynamics. The concept is shown to lead to a linear theory which incorporates the instabilities associated with sustained pile oscillations. (C.J.G.)

3192

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 16. NUCLEAR DATA AND REACTOR THEORY. Geneva, United Nations, 1958. 753p. $18.50.

The subjects covered in sessions A-11, A-12, and A-13—nuclear data, reactor theory, and computing methods—are fundamental to all reactor development programs and are certainly of specific interest to physicists engaged in any type of reactor program. There are some survey papers covering broad fields

of interest—cross sections, reactor kinetics, etc.—and many papers dealing with specific reactors and specific problems. (W.D.M.)

3193

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). British Patent 823,364. Nov. 11, 1959.

A reactor fuel element is described which consists of fuel tubes or rods mounted on wire racks or fixed at one end in graphite slabs. This arrangement gives better heat transfer. (T.R.H.)

3194

IMPROVEMENTS IN OR RELATING TO HEAT EXCHANGE SYSTEMS, PARTICULARLY FOR NUCLEAR REACTOR FUEL ELEMENTS. (to United Kingdom Atomic Energy Authority). British Patent 823,762. Nov. 18, 1959.

A system for improving heat transfer conditions in gas-swept reactor coolant channels containing longitudinally finned fuel elements. Deflectors are provided near the outer ends of the fins for mixing the gas and deflecting it into the spaces between. The deflectors are rings of oblique aerofoil cross section extending around the fins. (T.R.H.)

3195

JACKETED BODY. COMPLETE SPECIFICATION. (to United Kingdom Atomic Energy Authority). British Patent 823,921. Nov. 18, 1959.

A jacketed fuel element design is presented. One end of the fuel is tapped to receive a threaded extension of another rod. When the rods are bonded in their cans they are screwed together so that their cans are sealed fluid tight together. A braze or weld may also be used. If the joint leaks, expansion causes it to be sealed more tightly thereby preventing lateral expansion. (T.R.H.)

3196

PRESSURIZED WATER REACTOR WITH RADIALLY ARRANGED COOLANT TUBES. (to Siemens-Schuckertwerke Aktiengesellschaft). German Patent DAS 1 041 179. Oct. 16, 1958. Atompraxis 5, 375-6 (1959). (In German)

A heterogeneous reactor for especially high operating pressure is described. The reactor container is spherically shaped and the fuel elements are arranged in special coolant tubes. In this reactor by fixed arrangement methods and a favorable distribution of the fuel both the desired spherical geometry of the active core is approximated and also an exchange of fuel elements and coolant tubes is easily possible. The coolant tubes are distributed radially around a central point, which is determined by the common intersection of all coolant tube axes and which at the same time is used as suspension point for a remote-controlled loading machine. The fuel elements are placed within the coolant tubes. (J.S.R.)

3197

SINTERED FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Deutsche Gold- und Silberscheideanstalt vorm. Roessler). German Patent DAS 1 042 773. Nov. 6, 1958. Atompraxis 5, 375(1959). (In German)

Molded forms prepared by the sintering method and used for fuel elements should consist of uranium–oxygen compounds with an atomic ratio U:O of 1:2.05 to 1:2.40 and could be formed porous if necessary. The fuel elements so prepared can then be inserted unclad in the reactor, and direct contact will be avoided by the coolant. (J.S.R.)

3198

LOADING MACHINE FOR REACTORS. S. L. Simon (to U. S. Atomic Energy Commission). U. S. Patent 2,893,575. July 7, 1959.

An apparatus is described for loading or charging slugs of fissionable material into a nuclear reactor. The apparatus of the invention is a "muzzle loading" type comprising a delivery tube or muzzle designed to be brought into alignment with any one of a plurality of fuel channels. The delivery tube is located within the pressure shell and it is also disposed within shielding barriers while the fuel cartridges or slugs are forced through the delivery tube by an externally driven flexible ram.

3199

POSITIONING DEVICE. W. H. McCorkle (to U. S. Atomic Energy Commission). U. S. Patent 2,894,647. July 14, 1959.

A positioner for a control rod for a nuclear reactor is described. The positioner includes a spur gear and rack for adjusting the control rod slowly and in small amounts as well as a piston and cylinder for moving the control rod rapidly through larger distances. The positioner also has associated with it a worm wheel and gear for rotating it out of engagement with the control rod.

3200

NEUTRONIC REACTOR CHARGING AND DISCHARGING. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,894,892. July 14, 1959.

A method and arrangement is presented for removing a fuel element from a neutronic reactor tube through which a liquid coolant is being circulated. The fuel element is moved into a section of the tube beyond the reactor proper, and then the coolant in the tube between the fuel element and the reactor proper is frozen, so that the fuel element may be removed from the tube without loss of the coolant therein. The method is particularly useful in the case of a liquid metal-cooled reactor.

3201

FUEL ELEMENT FOR NUCLEAR REACTOR. K. G. Carney, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,894,893. July 14, 1959.

A nuclear fuel element comprising a large number of wafers of fissionable material and a protective jacket having compartments holding these wafers is described. The compartments of the jacket aid the removal of heat from the wafers, keep the wafers or fragments thereof from migrating in the jacket, and permit the escape of gaseous fission products.

3202

FUEL ROD CLUSTERS. A. B. Schultz (to U. S. Atomic Energy Commission). U. S. Patent 2,898,280. Aug. 4, 1959.

A cluster of nuclear fuel rods and a tubular casing therefor through which a coolant flows in heat-exchange contact with the fuel rods is described. The fuel rods are held in the casing by virtue of the compressive force exerted between longitudinal ribs of the fuel rods and internal ribs of the casing or the internal surfaces thereof.

3203

NEUTRONIC REACTOR CONTROL. S. Untermyer and E. Hutter (to U. S. Atomic Energy Commission). U. S. Patent 2,898,281. Aug. 4, 1959.

This patent relates to "shadow" control of a nuclear reactor. The control means comprises a plurality of elongated rods disposed adjacent and parallel to each other,

each of these rods consisting of alternate equal length sections of neutron absorbing materials and equal length sections of neutron permeable materials together with means for longitudinally positioning the rods relative to each other.

Research Reactors

3204 59-RL-2258M

General Electric Co. Research Lab., Schenectady, N. Y.
THE BEHAVIOR OF INTERNALLY GENERATED GASES IN FUEL AND CONTROL MATERIALS. D. W. Lillie. July 8, 1959. 40p.

The morphology and effects of gases generated within solid materials by nuclear radiations and other causes are reviewed. The relation of the behavior of such gases to the performance of nuclear fuels and control materials is emphasized. (auth)

3205 AECU-4444

Lockheed Nuclear Products, Marietta, Ga.
NUCLEAR TRAINING REACTOR. Preliminary Report and Hazards Analysis. Sept. 1959. 109p. For Ohio State Univ. (NR-63). OTS.

Complete descriptions of the reactor, building, and site are given. Reactor operation, hazards associated with the reactor, and the maximum credible accident are discussed. The reactor is a BSR swimming pool type with a design power level of 10 kw and a maximum thermal flux in the fuel region of 2.23×10^{11} n/cm^2-sec. (W.D.M.)

3206 NAA-SR-Memo-4394

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MULTIGROUP-MULTIREGION KINETICS OF THE AETR (FORMULATION). E. R. Cohen. Sept. 23, 1959. 27p. OTS.

The operational difficulties of running the AETR multigroup multiregion kinetics problems on an analog computer were investigated. (W.L.H.)

3207 NRL-5389

Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART X. SOME REACTIVITY MEASUREMENTS. K. W. Marlow, E. I. Nowstrup, and R. H. Vogt. Aug. 11, 1959. 22p. Project NR 543-000.

Reactivity measurements were made on the modified swimming-pool nuclear reactor at the U.S. Naval Research Laboratory. The reactivity effect was measured for a change from a configuration with three sides of the core reflected by water and three sides reflected by graphite to a configuration with all sides water reflected. Other reactivity effects measured include those due to movement of beam-port plugs, adjustment of control and safety rods, addition and subtraction of fuel, power changes, exposure thimbles at the edge of the core, and cadmium and gold in the center of the core. (auth)

3208 ORNL-2618

Oak Ridge National Lab., Tenn.
DISPERSIONS OF URANIUM CARBIDES IN ALUMINUM PLATE-TYPE RESEARCH REACTOR FUEL ELEMENTS. W. C. Thurber and R. J. Beaver. Nov. 19, 1959. 49p. Contract W-7405-eng-26. OTS.

The technical feasibility of employing uranium carbide–aluminum dispersions in aluminum-base research reactor fuel elements was investigated. This study was motivated by the need to obtain higher uranium loadings in these fuel elements. Although the MTR-type unit, containing a 13 to 18 wt. % U–Al alloy is a proven reactor component, fabrication problems of considerable magnitude arise when attempts are made to increase the uranium investment in the alloy to more than 25 wt. %. An approach to these fabrication difficulties is to select a compound with significantly higher density than UAl_4 or UAl_3 compounds of the alloy system which, when dispersed in aluminum powder, will reduce the volume occupied by the brittle, fissile phase. The uranium carbides, with densities ranging from 11.68 to 13.63 g/cm^3, appear to be suited for this application and were selected for development as a fuel material for aluminum-base dispersions. Studies were conducted at 580 to 620°C to determine the chemical compatibility of carbides with aluminum in sub-size cold-pressed compacts as well as in full-size fabricated fuel plates. Procedures were also developed to prepare uranium carbides, homogeneously disperse the compounds in aluminum, roll clad the dispersions to form composite plates, and braze the plates into fuel assemblies. Corrosion tests of the fuel material were conducted in 20 and 60°C water to determine the integrity of the fuel material in the event of an inadvertent cladding failure. In addition, specimens were prepared to evaluate performance under extensive irradiation. Prior to studying the uranium carbide–aluminum system, methods for preparing the carbides were investigated. Arc melting uranium and carbon was satisfactory for obtaining small quantities of various carbides. Later, reaction of graphite with UO_2 was successfully employed in the preparation of large quantities of UC_2. Studies of the chemical compatibility of cold-pressed compacts containing 50 wt. % uranium carbide dispersed in aluminum revealed a marked trend toward stability as the carbon content of the uranium carbide increased from 4.46 to 9.20% C. Severe volume increases occurred in monocarbide dispersions with attendant formation of large quantities of the uranium–aluminum inter-metallic compounds. Dicarbide dispersions, on the other hand, exhibited negligible reaction with aluminum after extended periods at 580 and 620°C. However, it was demonstrated that hydrogen can promote a reaction in UC_2–Al compacts. The hydrogen appears to reduce the UC_2 to UC which can subsequently react with aluminum producing the previously noted deleterious effects. A growth study at 605°C of composite fuel plates containing 59 wt. % UC_2 revealed insignificant changes within processing periods envisioned for fuel element processing. However, plate elongations as high as 2.5% were observed after 100 hr at this temperature. Severe blistering which occurred on fuel plates fabricated in the initial stages of the investigation was attributed to gaseous hydrocarbons, and the condition was eliminated by vacuum degasification of cold-pressed compacts. With the exception of the degasification requirement, procedures for manufacturing UC_2-bearing fuel elements were identical to those specified for the Geneva Conference Reactor fuel elements. Dispersions of uranium dicarbide corroded catastrophically in 20 and 60°C water, thus limiting the application of this material. However, specimens were prepared and inserted in the MTR to evaluate the irradiation behavior of this fuel because of its potential application in organic-cooled reactors. (auth)

3209

IRRADIATION FACILITIES FOR REACTOR STRUCTURAL MATERIALS IN HIGH FLUX REACTORS. R. Gain (Institut für Reaktorwerkstoffe der GFKF, Aachen). Atomwirtschaft 4, 435-9(1959) Oct. (In German)

Industry needs, at a favorable cost, irradiation facilities with a high flux of fast neutrons and a sufficient active volume for the suitability testing of reactor building materials.

The research reactors in Germany, the high-flux reactors in Europe, and the special material testing reactors in the USA and Canada are reviewed in terms of their suitability and availability for industry. (auth)

3210

ZENITH. G. Gunnill and G. H. Kinchin. Nuclear Eng. 4, 386-93(1959) Nov.

A discussion of the design of the Zenith is given with emphasis on alternative design possibilities in core and reflector temperature control, primary circuit design, materials of construction, instrumentation, and secondary containment for coolant gases. A diagram is given showing the relation of the reactor to its surrounding facilities. (C.J.G.)

3211

FILTRATION IN REACTOR GAS CIRCUITS. P. J. Froggatt (Atomic Power Constructions, Ltd., London). Nuclear Eng. 4, 406-7(1959) Nov.

A sintered iron filter with a 5-micron characteristic was developed for use in reactor gas circuits. The filter has an over-all length of 12 in. and a diameter of 3.75 in. The complete filter will pass 2,050 ft^3 per minute of air at 17°C and 12 psi differential. A pressure differential indicator is provided to give warning when the build-up of dust on the elements is excessive. (C.J.G.)

3212

TEST REACTOR FUTURES. A PANEL DISCUSSION. Nucleonics 17, No. 11, 124-31(1959) Nov.

A discussion is given on various aspects of the construction, operation, and utilization of test reactors. The use of Pu and UO_2 in fuel elements is discussed relative to their potentialities. The limitations of high-flux trap and light-water flux-trap reactors and the pulsed-type such as TREAT, KEWB, SPERT, and Godiva are described relative to their utilization in tests. The economics of test reactors are compared. (C.J.G.)

3213

NEUTRON LIFETIME MEASUREMENTS IN THE FAST REACTORS ZEUS AND ZEPHYR. G. Ingram, D. B. McCulloch, and J. E. Sanders (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 10, 22-31(1959) July.

Measurements of mean prompt neutron lifetime were made by a perturbation technique, by the use of a reactivity oscillator, and by the Rossi-α method in which the time correlation of fission chamber pulses is studied. The lifetime in Zeus was found to be 7×10^{-8} sec and in the graphite reflected version of Zephyr, 6×10^{-6} sec. (auth)

Power Reactors

3214 ACNP-5917

Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee.
BOILING WATER REACTOR WITH INTERNAL SUPERHEATER: PATHFINDER ATOMIC POWER PLANT FINAL FEASIBILITY REPORT. Aug. 31, 1959. 87p. For Northern States Power Co. and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. OTS.

The objective of the study was to determine and evaluate a means of improving and simplifying the boiling water reactor cycle through use of a nuclear superheater. Utilization of an integral nuclear superheater rather than a separate coal, oil, or gas fired superheater permits design of a simpler and more compact plant. The superheater concept described utilizes fuel elements which can be considered as available today. Power in the boiling and superheating regions is 164 Mw and 39.7 Mw. (W.D.M.)

3215 AECU-4459

Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT [FOR] SEPTEMBER 1959. 35p. Contract AT(11-1)-292. OTS.

The station output varied from 59 to 66 Mw gross from September 1 until September 6 on which date the station was shutdown. The Station remained shutdown from September 7 to 16 with the reactor operating as required for low power physics testing. From September 17 through the end of the month the Station was operated at two constant load plateaus to obtain the remaining practical power output of Seed I, Core I. The chemistry report indicated that reference water specifications for the reactor coolant system were maintained under all conditions. In the radioactive waste disposal system nine chemical waste tanks were filled, tested, and processed to the environment during the month of September. Health physics was primarily concerned with control of contamination, radiation and personnel monitoring. Sixty-five drums of non-combustible radioactive waste were shipped to Colts Neck, New Jersey for burial at sea. Corrective maintenance, and permanent repairs were performed during the month. The major items involved were the reactor plant cranes, the air monitor stations, and the fire protection system. The condensate demineralizer and the 1B enclosure sump pump were repaired; and maintenance was performed on items in the fuel handling building in preparation for refueling. In the Test Program 22 tests or sections of tests were performed during the month. Of the 32 tests originally scheduled 16 were performed and seven tests not originally scheduled were also performed. In addition 13 test procedures were issued in final form and ten test procedures were issued in draft form. Also during the month four test results were issued in final form and 23 test results were issued in draft form. The Duquesne Light Company Maintenance and Operational Training Program continued as permitted by the Station work load. Five welders were in training throughout September. In the Nuclear Power Station Training Program the classroom training phase was completed and the practical training phase was started. (For preceding period see AECU-4367.) (auth)

3216 AECU-4478

Duquesne Light Co., Shippingport, Penna.
LINEARITY AND DRIFT CHECK OF NUCLEAR INSTRUMENTATION AND REACTOR PROTECTION SYSTEM. SECTION I. FIRST AND SECOND PERFORMANCES. CORE I—SEED I. Test Results DL-S-288-S (RNI-30). First Issue, Oct. 21, 1959. 28p. OTS.

Precise data on the linearity and drift characteristics of the Nuclear Instrumentation power range amplifiers and the Reactor Protection System Vickers bi-stable magnetic amplifiers are presented. (auth)

3217 AECU-4490

General Atomic Div., General Dynamics Corp., San Diego, Calif.
RESONANCE ESCAPE PROBABILITIES FOR THE GRAPHITE MODERATED MGCR. Bernard Roos. Sept. 9, 1958. 12p. Project No. 40. Contract [AT(04-3)-187]. (GAMD-510; MGCR-R-1-16). OTS.

The calculations for the resonance escape probabilities in the MGCR were based on the Wigner method for heterogeneous systems. The fuel regions consist of homogeneous mixtures of U^{238}, O, Al, and Fe. The results of the calculations on fuel channels of 1, 1.5, and 2 inches in diameter, various $U^{238}O_2$ loadings, and different temperatures, are

presented. The geometrical dimensions were based on heat transfer considerations. (W.D.M.)

3218 AECU-4491

General Atomic Div., General Dynamics Corp., San Diego, Calif.

REACTOR PHYSICS OF MGCR GRAPHITE SYSTEMS. George T. Schnurer. Jan. 14, 1959. 32p. Project No. 40. (GAMD-545; MGCR-R1-55). OTS.

Basic data are given for the MGCR in terms of neutron temperature, macroscopic cross sections, two-group constants, burn-up, and fuel cycle costs. The nuclear properties of the reference design were determined by a study which covered a range of steel concentrations, voidage, and core size. Some of the more pertinent results of the reactor physics calculations are presented together with discussions of the methods employed. (W.D.M.)

3219 BAW-1134

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

NUCLEAR MERCHANT SHIP REACTOR PROJECT QUARTERLY TECHNICAL REPORT [FOR] OCTOBER–DECEMBER 1958. 93p. Contract AT(30-3)-274. OTS.

Calculations on fuel-rod clad temperature, reactor pressure drop vs. flow rate changes in power demand, hydraulic forces at startup conditions, and coolant transient trims were completed, establishing the final reactor core design. A total rod worth of 13.8% Δk was obtained for the reference core design. The boric acid concentration necessary to hold down Marty Core-VI with no control rods inserted, was 3.053 ± 0.008 g boric acid per liter of water. The excess reactivity of Marty Core VIII was determined as \$17 ± 1.5, or $k_{eff} = 1.13 \pm 0.015$ for $\gamma\beta = 0.00694$. The control and extension portions of the control rod will be chrome-plated to minimize galling. Vibration frequency of the control rod in water was 36 cps, compared to 54 cps in air. Calculations were performed on dose rates at points outside the secondary shield and on specific activity of the primary coolant water. (For preceding period see BAW-1124.) (W.L.H.)

3220 CF-53-12-9

Oak Ridge National Lab., Tenn.

ARE DESIGN DATA. William B. Cottrell. Dec. 1, 1953. Decl. Oct. 9, 1959. 34p. Contract [W-7405-eng-26.] OTS.

Design data on the Aircraft Reactor Experiment are summarized as of Dec. 1, 1953. The reactor is of the circulating fuel solid moderator type with a power rating of 1.5 Mw. A nominal fuel composition of 53.5 mole % NaF–40.0 mole % ZrF_4–6.5 mole % UF_4 is assumed. The moderator-reflector is of BeO cooled by sodium. (W.D.M.)

3221 CVNA-30

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

QUARTERLY PROGRESS REPORT FOR THE PERIOD APRIL 1 TO JUNE 30, 1959. July 20, 1959. 226p. For Carolinas Virginia Nuclear Power Associates, Inc. Contract AT(30-1)-2289. OTS.

The reactor will be fueled with uranium oxide of low enrichment and will operate at a heat output of about 60.5 Mw. Dry, saturated steam will be produced and delivered to the steam turbine, after superheating in auxiliary superheating equipment, at about 415 psi and 725°F. The nuclear steam generating plant will be designed as a prototype for a large-scale plant of about 200 Mwe or larger. The preoperational research and development program has as its prime purpose the study and development of the components comprising a pressure tube type reactor so that the prototype of a nuclear power plant can be constructed. During the quarter a major portion of the effort was devoted to the preparation of reference design II of the CVTR. Pursuant to this end, reference designs of the pressure tube, fuel assemblies, and other components were established and drawings of all the plant systems were prepared. Component refueling was selected as the method to be employed in the CVTR. A major improvement was made in the ability to predict the multiplication of a clustered fuel rod, heavy water moderated reactor lattice. Work was initiated toward the fabrication of some of the test components and models. By using an increased amount of thermal baffling in the pressure tube, the heat losses, by conduction, to the moderator were reduced from 2.9 to 1.9 Mw. This establishes the thermal output of the core as 61.9 Mw in order to deliver 56 Mw to the steam generator. Design parameters and physical data were selected for the reference design II steam generator. (For preceding period see CVNA-22.) (W.D.M.)

3222 DP-412

Du Pont de Nemours (E. I.) & Co. Engineering Dept., Wilmington, Del.

HEAVY WATER COMPONENTS TEST REACTOR, SAVANNAH RIVER PLANT: PLANS AND ESTIMATE. Oct. 1959. 31p. Contract AT(07-2)-1. OTS.

The Heavy Water Components Test Reactor (HWCTR) is described, a preliminary estimate of the cost of the facility is made, and a tentative construction schedule is presented. (auth)

3223 HRP-133

Norway. Institutt for Atomenergi, Halden.

FIFTH QUARTERLY PROGRESS REPORT ON THE OEEC HALDEN REACTOR PROJECT COVERING THE PERIOD JULY 1–SEPTEMBER 30, 1959. Olav Robert Kåsa. Oct. 16, 1959. 15p.

A successful start-up immediately before the reporting period was repeated twice to test instrument settings and operating procedure. Continued work on airlocks is reported, and physics and control experiments are described. The reactor was operational on 37 occasions for a total of 222 hours during the period, 104 hours of which were critical. A program of analogue computations on the reactor core and primary steam loop circuit for 5 Mw, 5 atm pressure and 30% subcooling is reported. Design of new control stations is proceeding. Six uranium oxide test elements were completed and are being tested. Activities in the health physics group are reported, and administrative information concerning the organization staff, reports issued, and fund expenditures are included. (J.R.D.)

3224 IDO-19005(Vols. I, II, and III)

Combustion Engineering, Inc. Nuclear Div., Idaho Falls, Idaho.

ABWR QUARTERLY PROGRESS REPORT [FOR] JULY 1 TO SEPTEMBER 30, 1959. Oct. 15, 1959. VOLUME I. SL-1 OPERATION AND EVALUATION. VOLUME II. SL-1 HEALTH PHYSICS AND SAFETY. VOLUME III. ABWR DESIGN AND DEVELOPMENT. (Vol. I, 64p.; Vol. II, 25p.; Vol. III, 143p.). Contracts AT(10-1)-967 and DA-44-192-eng-11. OTS.

These three volumes were issued separately, but are cataloged as a unit.

The program includes the operation and test evaluation of the SL-1 (ALPR) and an associated design and development program with the objective of obtaining improved, portable, and modularized BWR plants in the low power range. Volume I discusses SL-1 plant operational experi-

ence, outlines major maintenance and modifications performed, presents plant test activities, including a major section on the SL-1 power extrapolation program progress, and summarizes the technical administrative accomplishments during the quarter. Volume II summarizes the Health and Radiological Safety program in support of SL-1 operations. Included are discussions on personnel and area monitoring, radiological test and evaluation, special problem analysis, and industrial safety. Volume III presents the current Army Boiling Water Reactor design and development status. Included are major sections covering SL-1 design evaluation, PL-1 and PL-2 plant design, core analysis, and sustaining research and development. (W.D.M.)

3225 KAPL-1197(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

MULTIGROUP ANALYSIS OF PuO_2 POWER BREEDERS—PRELIMINARY RESULTS. J. B. Sampson and E. A. Luebke. Aug. 17, 1954. Decl. with deletions Aug. 28, 1959. 17p. Contract W-31-109-eng-52. OTS.

Several plutonium-fueled power breeder reactors have been analyzed by the multigroup method using an available UNIVAC coding. Breeders with fuel and fertile material in both oxide and metallic form were evaluated with the purpose of comparing characteristics of the oxide and metallic assemblies. A summary is presented of the nuclear data assumed, the method of calculation, and results obtained. A metallic reactor with four atoms U^{238} per Pu in the core and 54 vol.% Na has a critical mass of 230 kg and a breeding ratio of 1.65, of which 0.4 is internal. An oxide core reactor with four atoms U^{238} per Pu in the core and 44 vol.% Na has a critical mass of 275 kg and breeding ratio of 1.44, of which 0.48 is internal. A reactor with increased internal breeding is one having six atoms U^{238} per Pu as oxide and 42 vol.% Na, which has a critical mass of 430 kg and a breeding ratio of 1.54, of which 0.66 is internal. In an engineering design, the external breeding ratio may be lower, say 0.75, to account for increased leakage out of the end blankets. Replacing the metal U in the blanket with uranium oxide results in only 0.05 reduction in breeding ratio and should make possible more economical recycle of blanket material. (auth)

3226 KLX-1809

Vitro Engineering Co., New York.

STUDY OF NUCLEATION AND BUBBLE DYNAMICS TO EVALUATE VOID SHUTDOWN MECHANISM IN A HETEROGENEOUS WATER MODERATED REACTOR. Vitro Job No. 1238. S. Kaminsky. May 4, 1959. 95p. For Westinghouse Electric Corp. Bettis Atomic Power Div. Subcontract 73-(14-1025). OTS.

A two-fold effort is described which was directed toward the ultimate formulation of a function which can be used to predict void volumes during the "runaway" of a pressurized water reactor. The available literature was utilized and extended in an attempt to resolve the numerous phenomena associated with transient void formations in nucleate boiling. Attention was directed to void formations which occur during nucleate boiling because it is speculated that they are the principal formations present during fast transients in a pressurized reactor. (W.D.M.)

3227 NAA-SR-Memo-2980

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SNF—FUEL AND GRAPHITE ECONOMIC STUDY. R. E. Aronstein. Mar. 11, 1958. 21p. OTS.

Studies were performed to determine fuel costs for the reference Sheldon Nuclear Facility 19-rod oxide stainless steel can core vs. changes in enrichment. Also determined was the most economic grade of moderator graphite to use. A parameter study to aid in determining the effects of changing conversion ratio and enrichment on fuel costs was prepared. (W.L.H.)

3228 NAA-SR-Memo-3541

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

AXIAL HEAT GENERATION RATE IN PIQUA OMR. D. S. Bost. Feb. 12, 1959. 19p. OTS.

The heat generation rates in the Piqua OMR grid plates under operating conditions were determined. The axial heat generation rates in other principal materials were also determined. (W.L.H.)

3229 NAA-SR-Memo-3655

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DESIGN DIMENSIONS—CIRCULAR FUEL ELEMENT FOR THE PIQUA OMR. J. D. Wilde and M. Starr. Mar. 13, 1959. 13p. OTS.

Dimensions for the circular fuel element which allow for thermal growth, swelling due to irradiation, and estimates for practical manufacturing tolerances are determined. (W.L.H.)

3230 NAA-SR-Memo-3741

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ANALYTIC TECHNIQUE FOR DESCRIBING OCR PLANT TRANSIENT RESPONSE TO POWER DEMAND CHANGES. D. B. Sedgley. Apr. 16, 1959. 24p. OTS.

Studies were made to analyze OCR plant transients and determine adequacy of conceptual control system design. It was determined that the plant is capable of accommodating a 10% step load increase with the maximum reactivity insertion rate as limited by the OCR startup accident studies (3.5×10^{-4} Δk/sec) and with a steam generator coolant flow rate change of between 0.5 and 2.0%/sec. The steam pressure drop for these conditions is from 10 to 20 psi. Pressure recovery is achieved in 15 to 60 seconds depending on the rate of coolant flow increase in the steam generators. (W.L.H.)

3231 NAA-SR-Memo-3865

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PREHEATING TESTS USING STEAM TRACING. A. N. Gallegos. May 15, 1959. 16p. OTS.

The Piqua OMR will use steam tracing to preheat the piping and associated components in the coolant system to 300°F. The object of this work was to test the adequacy of this method of preheating by performing proof tests on an existing system which had been built to test pressure-relief valves. Additional tests were requested using a 3-ft length of 18-in. diam pipe to determine the minimum amount of steam tracing required and also to determine whether 175 psig steam could be used instead of 400 psig steam. Finally, to learn whether excessive temperature differentials would occur, thermocouple measurements were requested at designated locations on the pipe. (auth)

3232 NAA-SR-Memo-3977

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PIQUA OMR BURNUP STUDY. R. W. Hardy. May 28, 1959. 18p. OTS.

The radial power distribution of the core and the core K_{eff} were determined as a function of burnup and refueling. The required U^{235} enrichment and the effect of fission product poisoning on the reactivity were determined. The

atom concentrations of U and Pu isotopes were determined as a function of burnup. (W.L.H.)

3233 NAA-SR-Memo-4177
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
COOLING REQUIREMENTS FOR THE PIQUA SOURCE ELEMENT. M. Starr. July 29, 1959. 7p. OTS.

Studies were made to determine the cooling requirements for the Piqua OMR neutron source. Natural convection will adequately cool the source if entrance and exit ports are provided in the source tube to allow for the circulation of organic coolants through the Sb_2O_4–Be annulus. A conceptual design of the source that would be acceptable from the heat transfer viewpoint is presented. Pertinent temperatures in the source during full power reactor operation are given. (W.L.H.)

3234 NAA-SR-Memo-4224
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMR PIQUA DEGASIFICATION SYSTEM PROTOTYPE—SYSTEM DESCRIPTION AND EXPERIMENTAL PROGRAM. G. W. Corporales and P. R. Benson. July 27, 1957. 14p. OTS.

The quarter-scale experimental prototype of the Piqua Degasification System is presented. (W.L.H.)

3235 NP-8052
Atomic Power Development Associates, Inc., Detroit.
SPECIFICATION FOR NON-NUCLEAR INSTRUMENTATION AND CONTROL FOR THE ENRICO FERMI REACTOR PLANT AND ASSOCIATED FULL-SCALE TEST FACILITY. Specification No. 70-4. Revision No. 1. Paul D. Finger and M. R. Lane. Nov. 23, 1956. Revised Apr. 26, 1957. 102p. OTS.

Specifications for non-radioactive tests on non-nuclear instrumentation and control devices for the Fermi reactor plant are presented. Included are requirements for furnishing and delivery, ready for erection, detectors, indicating and recording instruments, control systems, and panels. (J.R.D.)

3236 PRDC-TR-27
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT: REPORT PERIOD—SEPTEMBER 1959. 27p. Contract AT(11-1)-476. OTS.

Progress in nuclear engineering materials, fuel engineering, reactor vessel engineering, mechanical handling, liquid metal and steam system, and test operations is summarized. Environmental radioactivity reports for the Enrico Fermi Reactor are included. (For preceding period see PRDC-TR-26.) (W.L.H.)

3237 IGIS-36(RD/R)
NUCLEAR PROJECTS OF ELECTRICITE DE FRANCE IN PROCESS AND BEING PLANNED. PARTS III AND IV. J. P. Roux. Translated by H. W. Curtis (U.K.A.E.A., Risley) from Rev. gén. elec. 67, 354-64(1958). 19p.

The general characteristics of the E.D.F.-1 installation are briefly described as they exist at present, certain solutions still being capable of modification. The CO_2 circuit, steam circuit, and auxiliary services are discussed. The program for the E.D.F.-2 is summarized briefly. (W.D.M.)

3238
HIGH-TEMPERATURE REACTOR AVR–BBC/KRUPP. Atom u. Strom 5, No. 8, 64-6(1959) Aug. (In German)

The high-temperature reactor is briefly described and an agreement concerning nuclear power installations between AVR GmbH and BBC/Krupp and involving the high-temperature reactor developed by Dr. Schulten. (T.R.H.)

3239
SHIP PROPULSION: THE ENGLISH PROJECT. Atoomenergie 1, 171-5(1959) Oct. (In Dutch)

A brief survey is given of the proposals for ship propulsion which were given to the British Admiralty by a number of English industries with the collaboration of the Atomic Energy Authority. The reactor types proposed are advanced gas-cooled reactor, boiling-water reactor, high-temperature gas-cooled reactor, organic-moderated reactor, gas-cooled reactor, and heavy-water reactor. (tr-auth)

3240
THE TIME-DEPENDENT CHANGES OF OPERATION CONDITIONS OF A THORIUM HOMOGENEOUS POWER REACTOR BEFORE THE STEADY STATE. A. Ōyama and R. Kiyose (Univ. of Tokyo). J. Atomic Energy Soc. Japan 1, 64-9(1959) June. (In Japanese)

The time-dependent changes of operational conditions, such as concentrations of isotopes of fuel materials and make-up or removal rates of fuel, are calculated. The reactor considered is a heavy water moderated thorium homogeneous reactor, having a single region core of 4 m in diameter. The equations of fuel isotope build-up coupled with the criticality equation are solved by numerical integration. Either pure U^{235} or pure Pu^{239} is assumed to be used both as the initial start-up fuel and as the make-up fuel. The thorium concentration and the operating power are kept constant in each cases at either 250 or 500 g/l D_2O and 655 or 1280 Mw. Calculations are made on a total of six different cases and the results are compared. In all cases, the initial make-up rate is found to be considerably higher than the burn-up rate of fuel itself because of the building-up of non fissile isotopes such as Pa^{233} and Pu^{240}. However, due to the building-up of U^{233}, the make-up rate required decreases fairly rapidly approaching to a certain asymptotic value, while in the case of a breeder, it becomes negative after a certain period of operation indicating that the removal of the excess uranium is necessary in order to maintain the criticality. It is observed also that the excess uranium removal can be started sooner in the cases of U^{235} start-up than in the case of Pu^{239} start-up. The actual removal rate of U^{233} gain is much higher in the case of Pu^{239} start-up than in the case of U^{235} start-up, for a certain period after the excess uranium removal started. Other problems of fuel cycles of thorium reactors are discussed. (auth)

3241
ELECTRICAL INSTALLATION AT CALDER HALL NUCLEAR POWER STATION. N. J. Mackay and E. Hardwick (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). J. Brit. Nuclear Energy Conf. 4, 263-81(1959) Oct.

The essential features of the installation are described with particular regard to the security of the supplies to the reactors. Main connections to the grid system and the method of electrical control are included. Details are given of the electrical equipment required for the normal operation of the reactors and also for emergency operation, should the main supply fail. The method of changeover from normal to emergency running is explained in some detail, since it affects the safety of the reactor and must be reliable. (auth)

3242
SOME RECENT PROGRESS IN NUCLEAR ENGINEERING. John Cockcroft (Churchill Coll., Cambridge, Eng.). J. Brit. Nuclear Energy Conf. 4, 348-57(1959) Oct.

The economics, power output, and application of various reactor types to marine engineering are evaluated. The reactors under discussion include pressurized water, boiling water, advanced gas cooled, organic liquid moderated, and high temperature gas cooled reactors. The safety aspects of nuclear propulsion are discussed. (C.J.G.)

3243

OMRE OPERATING EXPERIENCE. C. A. Trilling (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 17, No. 11, 113-17; 234 (1959) Nov.

The design of the Organic Moderated Reactor Experiment (OMRE) is given. The operating history of the first core loading is summarized. Polyphenyl decomposition rates in relation to reactor power are discussed. The decomposition products of the polyphenyl coolant are given and the irradiation effects and activation of the coolant described. (C.J.G.)

3244

OMCR POWER PLANTS: THEIR STATUS AND PROMISE. S. Siegel and R. F. Wilson (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 17, No. 11, 118-23; 236(1959) Nov.

The technological status of organic reactor development is discussed relative to coolant technology, component development, heat transfer, process systems, fuel materials, and reactor physics. A fuel element containing UO_2 and clad with aluminum powder containing 6 to 8% Al_2O_3 is discussed. Distillation proved most effective for coolant purification. Power flattening in the core permits greater power extraction from a given size of core and lower maximum coolant velocities and pressure drops with a corresponding increase in neutron performance. Technical advances in organic-reactor power plants are discussed relative to design, power output, and economy. (C.J.G.)

3245

FIXED CHARGES OF NUCLEAR PLANTS. J. A. Lane (Oak Ridge National Lab., Tenn.). Nucleonics 17, No. 11, 168, 170(1959) Nov.

In comparing the economics of nuclear vs. conventional power plants, an estimate of nuclear power costs is given using the same distribution of fixed charges and methods of financing as for a typical privately owned coal-fired plant, 60% bonds and 40% equity. The effect on power cost of proposed financing is discussed for the conventional coal-fired and low-inventory and high-inventory-fuel-cost nuclear plants. (C.J.G.)

3246

PHYSICS OF THE BBC-KRUPP HIGH TEMPERATURE REACTOR. Von R. Schulten, C. B. v.d. Decken, H. W. Schmidt, and H. Wundt (Arbeitsgemeinschaft BBC-Krupp, Mannheim, Ger.). Nukleonik 1, 277-86(1959) Oct. (In German)

A high-temperature power reactor presents, in comparison with better known reactor types, a whole series of additional physical problems. The BBC-Krupp reactor is a thermal reactor moderated by graphite, fueled with 20% enriched uranium carbide in carbon spheres, and cooled with a helium–neon mixture. The methods of solving the problems with respect to the cooling, decontamination, fuel and breeder materials, breeding possibilities, burn-up, and loading are discussed qualitatively. The reactor kinetics are also considered. (J.S.R.)

3247

AIRCRAFT NUCLEAR PROPULSION PROGRAM. HEARING BEFORE THE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON THE AIRCRAFT NUCLEAR PROPULSION PROGRAM, JULY 23, 1959. Washington, D. C., Joint Committee on Atomic Energy, 1959. 421p.

Public hearings of the JCAE Subcommittee on Research and Development were held on July 23, 1959, and testimony was received from the project director, General Keirn, and representatives of the Air Force and Navy, McCone of the AEC, Gates of DOD, and York of DOD. (W.D.M.)

3248

NUCLEAR REACTOR. J. J. Grebe (to U. S. Atomic Energy Commission). U. S. Patent 2,894,891. July 14, 1959.

High temperature reactors which are uniquely adapted to serve as the heat source for nuclear powered rockets are described. The reactor is comprised essentially of an outer tubular heat resistant casing which provides the main coolant passageway to and away from the reactor core within the casing and in which the working fluid is preferably hydrogen or helium gas which is permitted to vaporize from a liquid storage tank. The reactor core has a generally spherical shape formed entirely of an active material comprised of fissile material and a moderator material which serves as a diluent. The active material is fabricated as a gas permeable porous material and is interlaced in a random manner with very small inter-connecting bores or capillary tubes through which the coolant gas may flow. The entire reactor is divided into successive sections along the direction of the temperature gradient or coolant flow, each section utilizing materials of construction which are most advantageous from a nuclear standpoint and which at the same time can withstand the operating temperature of that particular zone. This design results in a nuclear reactor characterized simultaneously by a minimum critical size and mass and by the ability to heat a working fluid to an extremely high temperature.

WASTE DISPOSAL AND PROCESSING

3249 AECU-4331

Nuclear Science and Engineering Corp., Pittsburgh and Nichols Engineering and Research Corp., New York. TREATMENT AND DISPOSAL OF HIGH-LEVEL RADIOACTIVE LIQUID WASTES. Eli I. Goodman and Herman L. Sturza. Dec. 1958. 286p. Contract AT(36-1)-44. OTS.

The major purpose of this publication is to collect all pertinent data on treatment and disposal of radioactive wastes into one volume in order to: provide a basic reference for existing methods; indicate the status of research and development projects; and present an outline of proposed methods. Coverage was limited to consideration of high-level radioactive liquid wastes. At the present these wastes come from nuclear-fuel reprocessing plants. Chapter two highlights and summarizes the important aspects of the text. Chapter three acquaints individuals whose technical training is not specifically in nuclear subjects with the fundamentals they need to understand radioactive wastes. In chapter four the basic nature of the problem and its relation to the nuclear economy is presented. Chapter five presents the data on the radiological safety aspects of this problem. In chapter six the available information on the economic aspects of the problem is summa-

rized. Chapter seven is primarily concerned with liquid-waste storage technology. Chapter eight presents data on evaporation, acid removal, neutralization, adsorption and ion exchange, solvent extraction precipitation and crystallization, drying, pyrolysis, and thermal fusion. Chapter nine deals with final-disposal methods such as ocean disposal, shallow-pit disposal, deep-well disposal, self-fixation in pits, and cave and mine storage. (W.L.H.)

3250 CF-59-9-115

Oak Ridge National Lab., Tenn.

RADIOACTIVE WASTE TREATMENT AND DISPOSAL—A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE, PART 3. J. O. Blomeke. Sept. 28, 1959. 28p. OTS.

This bibliography of the unclassified literature on radioactive waste treatment and disposal was compiled from references published in the Nuclear Science Abstracts, Volume 12, No 13 (July 15, 1958) through Volume 13, No. 14 (July 31, 1959). This bibliography brings up to date previous bibliographies published as CF-57-8-118 and CF-58-7-77. (auth)

3251 NAA-SR-Memo-3809

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HAZARD EVALUATION OF STACK EMISSIONS FROM THE HBR BURNING EXPERIMENT. G. W. Spangler. May 18, 1959. 5p. OTS.

Studies were made to investigate the stack emission problem connected with the High Boiler Residue (HBR) burning experiment at the Santa Susana site. The stack emissions from the HBR burning experiment could produce concentrations greater than MPC on the site if the emission rate for MFP exceeds 10^{-3} μc/sec or if the S^{35} emission rate exceeds 1 μc/sec. (W.L.H.)

3252 WAPD-CDA(AP)-106

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

DISPOSAL OF SPENT DEMINERALIZER RESIN FROM NUCLEAR-POWERED SHIPS. B. G. Schultz. June 4, 1958. 5p. Contract [NObs-67500].

A report is presented on the normal activity associated with spent resin from nuclear ship reactors, the settling rates of these resins in sea water, and equipment and procedures for catching the spent resin at dockside and for disposal of flushing water. A diagram of equipment for dockside disposal is included. (J.R.D.)

3253

RADIOACTIVE WASTE MATERIALS. I. THE ORIGIN OF RADIOACTIVE WASTE MATERIAL. H. J. Wervers. Atoomenergie 1, 161-6(1959) Oct. (In Dutch)

A survey is given of the origin and magnitude of the radiowaste problem. The quantity of fission products to be expected in the future was discussed more fully. Consideration was also given to activation products. (tr-auth)

3254

STUDY ON GENERAL CHARACTERISTICS AND DISTRIBUTION OF ION CONCENTRATION IN ION EXCHANGE-ELECTROLYTIC EQUIPMENT. J. Shimokawa and G. Nishio (Japan Atomic Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 225-33(1959). (In Japanese)

An electrolytic deionization apparatus in which spherical ion exchangers and permselective ion exchange membranes were included was made for the treatment of radioactive aqueous wastes. The general characteristics of the ion exchange-electrolytic equipment are discussed in comparison with the ion exchange column and the ion exchange membrane equipment. Equations for the distribution of ion concentrations in the deionization cell of the apparatus were derived as a function of feed concentration, flow rate, electric voltage, current, current efficiency, equivalent conductivities of ion exchangers and solutions, volume fraction of particles, and cell geometry. Radioactive Na^{24} tracers were utilized to measure actual ion concentrations in the deionization cell. The experimental data for low solid wastes indicate that the electrolytic process incorporating resin particles and resin membranes is superior to the simple process using permselective membranes only. (auth)

3255

OBSERVATION OF ATMOSPHERIC DIFFUSION AT TŌKAI-MURA. Y. Kawabata. J. Atomic Energy Soc. Japan 1, 330-9(1959). (In Japanese)

Atmospheric diffusion was observed at Tōkai-mura by measuring the diffusion of PbI_2 from a stack 65m in height. The results were found in good agreement with theoretical calculations. (C.J.G.)

3256

APPLICATION OF PRESENT WORTH TO WASTE-DISPOSAL ECONOMICS. W. J. George and L. R. Bacon (Wyandotte Chemicals Corp., Mich.). Nucleonics 17, No. 11, 173-4; 176; 178; 180(1959) Nov.

Calculations are presented for various methods of waste storage based on the assumptions: 50-yr lifetime of underground storage tanks, Purex-type waste, and 800 gal of waste per ton of spent fuel. The present worth of tank-storage costs, salt–cavity-storage costs, and combined tank-salt–cavity costs was calculated and a costs comparison of these three systems given. It is shown that either a combination tank-salt–cavity system or a salt–cavity system alone leads to lower costs for liquid waste storage than tank storage alone. (C.J.G.)

3257

RADIOACTIVE WASTE DISPOSAL INTO ATLANTIC AND GULF COASTAL WATERS. A Report from a Working Group of the Committee on Oceanography of the National Academy of Sciences–National Research Council. Second Printing. Publication 655. Washington, D. C., National Academy of Sciences–National Research Council, 1959. 42p. $1.00.

Taking into account the effects of local oceanographic conditions and possible health hazards, recommendations are made as to the amounts of different radioactive isotopes that can be disposed of safely in any one area. The study provides an estimate of the rate of return of radioactive substances to man. A theoretical study of dilution by turbulent mixing processes was also made. Because of the assumptions made, all estimates of concentration at a given distance and time are probably higher, by at least a factor of ten, than would actually exist in practice. An estimate was made of the maximum permissible concentration of each of several radioisotopes in sea water, below which contamination of marine food products will not lead to greater than allowable intake by humans. Twenty-eight possible disposal sites are listed. (C.J.G.)

3258

STORAGE OF RADIOACTIVE DECAY PRODUCTS IN POLAR ICE. Bernhard Philberth. German Patent DAS 1 043 535. Nov. 13, 1958. Atompraxis 5, 376(1959). (In German)

The storage of radioactive decay products in arctic or antarctic ice, which receives on its surface constant mass

increment by precipitation from the atmosphere, is proposed. With consideration of the relatively large transmission time and decay time of the polar ice masses and the especially good physical behavior of the ice in this case, a simple and safe disposal of decay products is possible in this manner. (J.S.R.)

3259

TREATMENT OF FISSION PRODUCT WASTE. J. B. Huff (to U. S. Atomic Energy Commission). U. S. Patent 2,897,049. July 28, 1959.

A pyrogenic method of separating nuclear reactor waste solutions containing aluminum and fission products as nitrates comprising, spraying the solution on a bed of burning petroleum coke in an underground retort, collecting the easily volatile gases resulting as the first fraction, then passing chlorine gas through the bed and collecting the resulting gaseous chlorides, including aluminum chloride as the second fraction, permitting the coke bed to cool and collecting the ash as the third fraction, which will contain all the longest lived radioactive fission products in greatly reduced volume.